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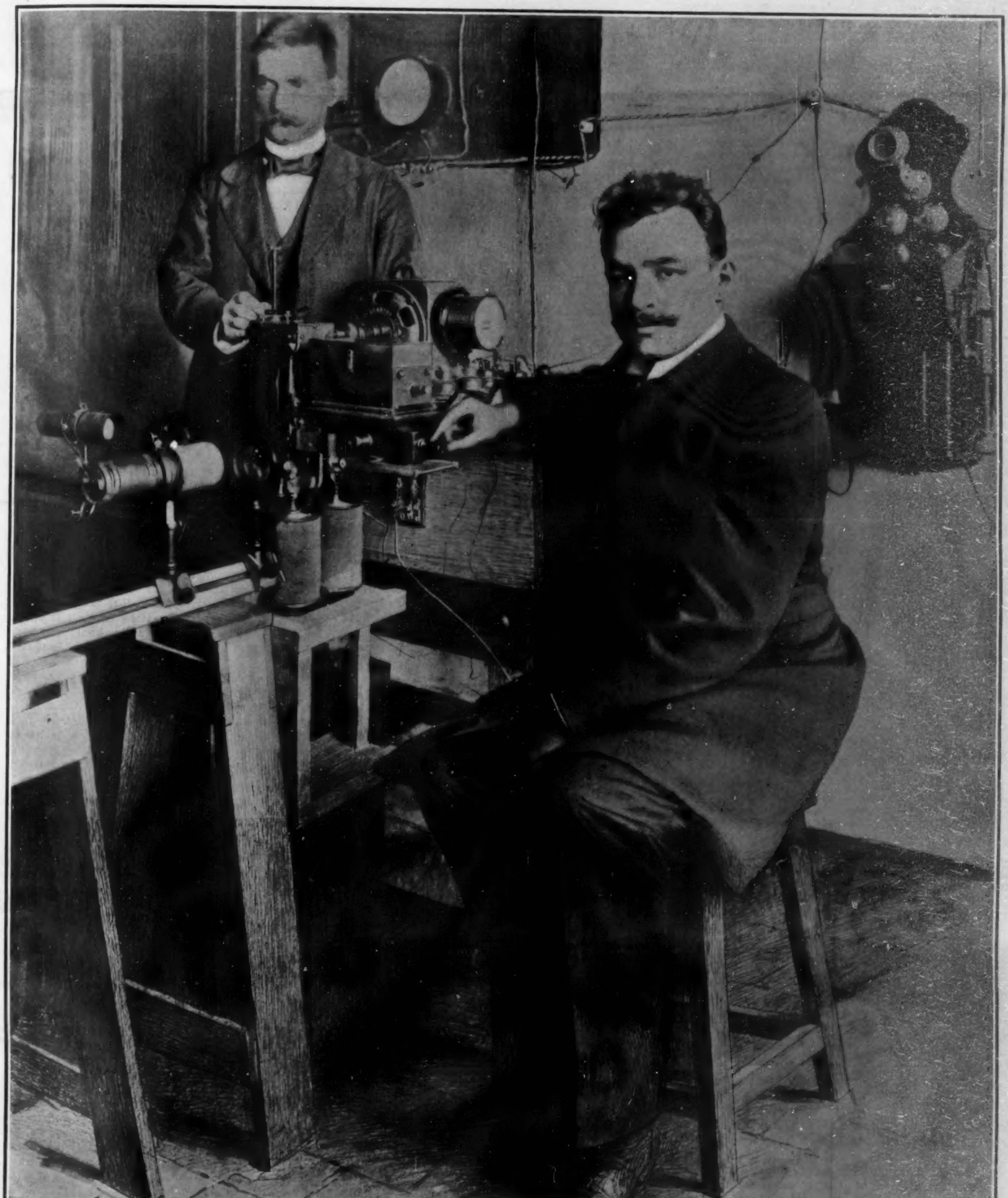

Prof. Korn Operating the Transmitting Apparatus of His Telephotographic System.

RECENT DEVELOPMENTS IN PICTURE TELEGRAPHY.—[See page 288.]

SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, OCTOBER 26, 1907.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

INAUGURATION OF MARCONI TRANSATLANTIC WIRELESS TELEGRAPHY.

It always affords the Scientific American very real pleasure to record the final success of an inventor, who has shown the intelligence and indomitable perseverance which have characterized Mr. Marconi in his six years' struggle to achieve the seemingly impossible, and establish a system of wireless transatlantic telegraphy between the old and the new world. It is certain that among the many names which will always be honorably associated with the development of wireless telegraphy, that of the young Anglo-Italian will ever hold the place of honor. We say this with full knowledge of the fact that the foundation for his accomplishment was laid over thirty years ago, when Clerk Maxwell, in an address to the Royal Society, defined the character of the ether waves and predicted the possibility of wireless telegraphy by means of electro-magnetic waves. Nor are we forgetful of the fact that in 1887 Prof. Hertz, by the announcement of his discoveries, earned the right to give his name to the etheric waves which Marconi and his contemporaries have turned to such good account.

Marconi's experimental work in transatlantic communication dates from that notable day in December, 1901, when from his position at the top of a lofty promontory at the entrance to St. John's harbor, Newfoundland, he received from his station in Cornwall, England, an agreed-upon signal, the letter S. Encouraged by this success, Marconi commenced the erection of a powerful station at Glace Bay, Nova Scotia, where four huge braced towers were built at the corners of a square, and an elaborate system of aerial wires or antennæ strung from them and led down to the sending and receiving station below them in the center of the square. A year later actual wireless telegraphy communication was established between this station and England, and dispatches were sent by the Governor-General of Canada to King Edward, the King of Italy, and the London Times. Subsequently, a message was dispatched from President Roosevelt to King Edward, and it was announced that regular transmission was about to be inaugurated. Apparently the time was not yet ripe for this, and during the past four years the inventor has been devoting himself with unrelenting energy to the perfecting of his apparatus. The power of the plants on both sides of the Atlantic has been greatly increased, with the result that on October 17 the system was declared open for the sending of press dispatches, and on that day over 10,000 words were sent and received. In a few days' time the system is to be opened for regular commercial dispatches, and there is a general belief that at last Marconi has triumphed over all difficulties, and has seen the successful completion of his life work.

ANOTHER TUNNEL BENEATH THE EAST RIVER COMPLETED.

The contracting company which for the past two years has been at work upon the two tubes of what has come to be known as the Belmont tunnel, have completed their work and turned over the tubes to the engineers of the tunnel company, who will actively push forward the work of putting them in condition for operation. This enterprise has been rendered possible by the existence of an old franchise, which was purchased by the company with a view to utilizing its sanction in building an independent two-track tunnel between Forty-second Street, Manhattan, and Long Island City. The crossing consists of two separate tubes with a single track in each; and in its general design and construction it resembles the Rapid Transit tunnel which is soon to be opened beneath the East River at the Battery. The company have not definitely stated what lines will connect with the new tunnel; but there is no question that ultimately it will form an important link between the Rapid Transit systems in Manhattan and Long Island. As an instance of rapid contracting work, it is highly creditable to the builders; for ground was not broken for construction until July 14, 1905. The work was attacked from three points, one heading being driven from the Manhattan side, another from Long Island, and two other headings being driven from the bottom of a shaft, sunk through a reef in the middle of the East River and on the line of the tunnel. The rapid progress of the work was largely due to the fortunate existence of this reef; since it was possible to drive a heading in each direction from the bottom of the shaft, and the engineers were thus enabled to have four shields in operation in each tube at the same time. In the driving of the shields the Degnon Contracting Company encountered their full share of the difficulties which are presented by the unfavorable character of the bed of the East River. It is stated that, at times, the shields were so near to the bed of the river that they were actually exposed to the wash of the river water, and, of course, this means that there was the usual exasperating trouble of blowouts. At the present writing, the north tube is completed and an experimental car is in service. There remains now only the laying of the track and installing of electric power in the south tube, to render the whole tunnel complete and ready to take its place as part of the general system of Rapid Transit in Greater New York.

DIRIGIBLE BALLOON IN WARFARE.

For the very simple reason that they are only now beginning to exhibit qualities which give them distinct military value, the Scientific American has hitherto had little to say as to the military value of dirigible balloons and airships. During the past year, however, the advance which has been made in the development, both of the dirigible balloon and the aeroplane, has been so marked and they have received such distinct government recognition, that the value of these machines as instruments of war has become a question of international importance. The military authorities of the leading nations of the world have established aeronautical corps, and by three, at least, of these the dirigible balloon has been made the subject of exhaustive experiment; while the aeroplane is also receiving its due share of attention. It was natural that the French, the nation of engineers to whom the world is indebted for the development of the automobile and the motor boat, should have been the first to turn their attention to the air, and give official recognition to the motor-driven balloon. It was the multi-cylinder gasoline engine which rendered the present perfection of the automobile possible; and it is to the excellent qualities of this same engine that the balloon owes its development from a huge gas-filled sphere, helplessly driven by the wind, to a shapely and well-braced machine, capable of making 30 miles an hour in still air, and of holding its own and even making headway against a wind of moderate strength.

A brief review of the present conditions, shows that among the three nations which have given official recognition to the airship, the French army possesses four dirigibles, the "Lebaudy II," "La Patrie," "Republic," and one other, which is at present under construction. The German army has the "Zeppelin," the largest airship ever constructed, the "Gross," and the "Parseval;" while England has recently completed and successfully tried the "Nulli Secundus." Taking these machines in their order, there are the "Lebaudy II"—a copy of an earlier machine, manufactured by the brothers of that name, which was the first really practical dirigible. It seems to have been a success almost from the very start, its owners making several successful flights for distances of from 10 to 30 miles. The military authorities were so favorably impressed, that it was purchased for the use of the aeronautical corps of the army. By them it was subjected to a long series of experiments, and upon the data thus secured it was decided to build three other dirigibles. Two of these, the "Patrie" and "Republic," have been completed, and the former has done some really excellent work. The "Patrie," of 111,195 cubic feet capacity, is 33¾ feet in diameter by 196 feet in length, and carries motors of 70 horse-power driving two propellers. The machine can lift about 2,800 pounds of dead weight, and it has made an official speed of about 30 miles per hour.

The largest dirigible in the world is one built by Count von Zeppelin and sold to the German government. It is 40 feet in diameter by 420 feet in length. It carries two engines of 80 horse-power, each of which drives twin propellers, carried at the sides of the machine. In spite of its great weight, the lifting capacity of the Zeppelin is considerable; for it is claimed that it can carry fully three tons of dead weight. This machine has been tested very thoroughly during the past summer, and, judging from the cable dispatches, it has shown considerable speed, and the ability to maneuver successfully. On one occasion it was taken out and driven against a 33-mile per hour wind, against which it was able to maintain itself stationary. On another occasion it remained in the air continuously for seven hours; and made a flight of 220 miles at a speed of over 30 miles an hour. The two other German machines are from designs by officers of the German army. The "Gross," of 64,000 cubic feet capacity, is 39 feet in diameter by 130 feet in length; it carries a 35 horse-power motor, and is credited with a speed of 29 miles per hour. The "Parseval," a much larger design, is of 106,000 cubic feet capacity and carries a 90-horse-power motor. A curious feature of this airship is that the blades of the single propeller consist of centrifugal ribbons which, as they are revolved, fly out and adjust themselves at the proper pitch. The "Parseval" has made 20 to 30 mile trips, and has stayed in the air for several hours at a time.

During the past few weeks the aeronautical corps of the British army have made some successful tests of their first practical airship, the "Nulli Secundus," which is 30 feet in diameter by 100 feet in length and can carry three or four men. The speed is slightly over 20 miles per hour; and in a recent trip it was driven from Farnborough and maneuvered above the city of London, where it was put through various evolutions with apparent ease. A distinctive feature of the "Nulli Secundus" is a pair of aeroplanes, one on each side of the balloon, which can be folded against the gas bag when they are not in use.

Now that the airship has received military recognition, the question may well be asked, What is its military value? Undoubtedly, it will form a most important weapon in the hands of the intelligence department. For scouting purposes, when the winds are favorable and the air is clear, it will prove to be of the very greatest value; for under such atmospheric conditions it will be possible for a scouting party to rise to a sufficient elevation to avoid the enemy's rapid-fire guns, and sail at will above the country in which hostile operations are being conducted. While so engaged it will be possible to take photographs of fortifications; locate the position of masked batteries; and determine the strength and disposition of the enemy's forces. In fact, the scouting dirigible balloon will destroy, at once, that secrecy upon which the success of a plan of battle so greatly depends.

We think, however, that in its present stage of development, the dirigible balloon cannot be considered to have any great offensive power. The "Zeppelin," it is true, could carry some three tons of explosives; but even with this aboard and put up in the form of high-explosive impact shells, it is quite questionable if they could be dropped with any degree of accuracy; and it is well recognized among artillerists that "pot-luck" shooting, that is the haphazard dropping of shells into a camp or fortification, produces very little decisive result. For effective work shots must be aimed, their fall watched, and the place of striking made known to the artilleryman, who from a fixed position can correct his aim on the information thus imparted, until the mark is reached. The airship, being a moving body and unstable, and obliged, because of the menace of artillery, to drop its shells from some thousands of feet above the earth, would have to indulge in "pot-luck" firing. Moreover, the menace of the airships is certain to be met by the construction of vertical-fire guns designed specially for their destruction.

Here, in the United States, the War Department has elected to follow rather than lead in the development of the new weapon. It is true, we have seen this year the formation of the balloon corps of the army; but nothing has been done, either by purchase or independent investigation, to produce a military dirigible balloon. The Wright brothers, whose American aeroplane is so far in the lead that there is literally no other to be considered, are now in Europe negotiating for its sale to a foreign government. With such men as the Wright brothers, Baldwin, Stevens, and Knabenshue successfully navigating their aeroplanes and airships, it would be strange, if it were not so characteristic, that our military authorities should sit still in lofty indifference to what is being done by civilians in this promising field of effort.

Experiments being made with cassava, under the direction of the U. S. Department of Agriculture, show it to be one of the best alcohol-producing plants, a ton of the root-stock yielding thirty-five gallons of alcohol. The plant is easily and cheaply grown, and the yield is very large, soil of average quality yielding ten tons to the acre. At from 35 to 40 cents a gallon, the gross profit would therefore be from $35 to $40 an acre. This profit is greater than that derived from the alcohol potato raised so abundantly in Germany and Russia.

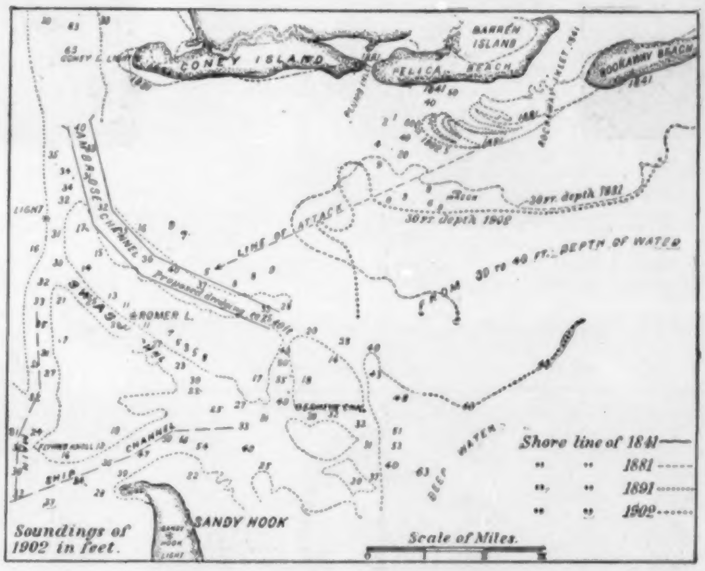
EFFECT OF AMBROSE CHANNEL UPON OTHER WATERWAYS IN NEW YORK HARBOR.

We direct attention to the letter of a correspondent, published elsewhere in this issue, which raises the question as to the probable effect of the opening of the Ambrose channel upon the other waterways of the harbor. The matter is one of decided interest, and, if there is any likelihood of the various channels being harmfully affected, it becomes a question of the highest importance. We are of the opinion, however, that although there may be a tendency to shoaling in some of the contiguous channels, it will not be so serious as to prohibit their use; while in any case the great width of the Ambrose channel, which when completed will have a width of 2,000 feet, will prove ample to accommodate all the traffic that enters and leaves New York harbor. Our correspondent is correct in supposing that a direct passage, 40 feet in depth at low water, and nearly half a mile in width, will have some effect upon the flow of the water of the incoming and outgoing tides. In the first place, the provision of a channel to the sea, out of which 42,000,500 yards of material have been dredged, will naturally attract to itself the main flow of the tidal waters of the upper bay. Such water as formerly sought the old ship channel, with its shoaler depth and narrower width, will now naturally seek the line of least resistance presented by the broad and deep Ambrose channel; and this cannot fail to produce a slackening of the flow in the older and more circuitous channel. The velocity of the water being somewhat less, there will be a larger deposit of the silt contained therein, and we may look for a tendency of the old ship channel to shoal up somewhat until a depth is reached corresponding to the reduced velocity of the current.

Although, theoretically, there should be an acceleration of the tidal flow through the East and North Rivers due to its freer delivery through the lower bay, we think that the difference will be so slight as to be negligible. For although an enormous quantity of water can be passed through a channel 40 feet deep and 2,000 feet wide, the prism of this channel forms but a small proportion of the total sectional area of the entrance between Coney Island and Sandy Hook. In other words, we believe that the readjustment of flow, both as to direction and velocity, will be confined to the stretch of water extending between the outer bar and the Narrows, or what is known as the Lower Bay.

But when our correspondent touches on the question of the readjustment of the sands to seaward of the outlet of the new channel, he brings up what to our mind appears to be the most important question of all. The channel, as completed, will extend seaward until it has cut through the outer bar, and reached deep water at the 40-foot contour line. This bar and the series of shoals extending from Sandy Hook to Rockaway Beach have been formed and are maintained by the littoral drift from the shores of Long Island and New Jersey. The action is one which is well understood by government harbor engineers, and these bars and low, sandy spits or headlands are the result of the joint action of the outflowing tide, bearing its burden of sand and detritus from the rivers and harbors, and of the waves and offshore currents. The ability of flowing water to hold finely-divided mechanical matter in suspension depends, among other things, upon its velocity. As the velocity decreases the matter is deposited. Hence it is that at the outlet of the river, channel and other waterways which bring down quantities of silt, the current losing its velocity as it mingles with the ocean, releases its deposits and sand bars are formed. These bars are also increased by the action of the waves in transporting the sands from the neighboring beaches in a direction parallel with the shore and piling them up in the form of "spits," or "hooks." The question of the future formation of a sand bar to seaward of the new channel depends upon the coaction of many contributory forces, and cannot, with any certainty, be denied or predicted. If the depth increases rapidly beyond the 40-foot contour line, and the ocean currents flowing past the channel entrance are fairly strong and steady, there is little likelihood of such a bar being formed.

Although there is little fear of the closing of the Ambrose channel entrance by bar formation, it cannot be denied that in future years it may become necessary to safeguard the channel against attack by the encroachment of the sands of Rockaway Beach. The littoral drift of the sand of this beach is steady and very rapid, as, indeed, is that of all the sandy beaches of the Atlantic shore of Long Island. It was pointed out in these columns a few years ago by Prof. Lewis M. Haupt that a study of the charts reveals the fact that Fire Island Inlet has drifted to the west at the average rate of 200 feet per annum. Rockaway Inlet has traveled south as well as west, at the rate of three miles in sixty years, or over 260 feet per annum; and, should it continue its advance in its present direction, it will ultimately reach the Ambrose channel at a point about a mile and a half from its seaward entrance. It should be understood that the danger is not a pressing one; but it is sufficiently serious to demand that some steps be taken by means of jetty or training wall to enlist the action of the tides in arresting its further progress.



Note advance of Rockaway Beach toward the Ambrose Channel.

PLAN OF NEW YORK HARBOR ENTRANCE.

THE EVIDENCE OF LIFE ON MARS.

A SIMPLE MATHEMATICAL PROOF THAT THE CANALS ARE NOT DUE TO NATURAL CAUSES.

BY A MATHEMATICIAN.

The reason for looking askance at the discoveries about Mars is, of course, the old reason that man shies instinctively at the new and strange, plus the added one of his innate aversion to admitting peers. All advances in knowledge of any import have had to contend against this spirit, as one versed in the history of science is aware. But inasmuch as, when the theory has triumphed, one hears no more of the objections, the averagely educated man is ignorant of the discredit through which it passed. A most interesting article could be made out of this point alone. Without mentioning such examples as Galileo and Darwin, let me give you a few instances not so commonly known.

1. Luther voiced the general opinion about Copernicus at the time when he called him "an upstart philosopher and a fool." It was not till long after Copernicus's death that astronomers accepted the Copernican system.

2. Nearly half a century after the Principia of Newton was published, the French Academy awarded to Jean Bernouilli a prize for a paper explaining the movements of the planets on Descartes's theory of vortices, thereby officially condemning Newton's work. As for Newton's contemporaries, they were all but unanimous in their condemnation of the Principia, even the great Huyghens contributing.

3. Huyghens's wave theory of light was denied by the world generally, and the English in particular, because Newton had adopted the erroneous corpuscular theory.

4. A long time elapsed before the now celebrated law of Avogadro (he it was who conceived the idea of a molecule as composed of atoms), one of the most fundamental to modern chemistry, was accepted.

5. Roemer's detection of the velocity of light from the eclipses of Jupiter's satellites was ridiculed and ignored for more than a century.

6. It took some time for Harvey's circulation of the blood to circulate freely through the brains of mankind.

7. At the very instant that Ceres was being regained by Gauss's analytics, Hegel, Germany's leading philosopher at the moment, published a pamphlet demonstrating the absurdity of the existence of any such planet.

8. Joule's work on the mechanical equivalent of heat was saved from oblivion only by pertinent questions of (the then young) Kelvin at the scientific meeting at which it was presented and was about to be condemned.

9. Helmholtz's great paper on the conservation of energy was refused publication by the leading physical journal of Germany at the time.

10. Faraday's electrical results were disdained by mathematicians till Clerk Maxwell showed them to be correct from an analytic standpoint.

11. Airy, Great Britain's first astronomer at the time, was so skeptical of Adams's analytic discovery of Neptune, that he prevented the actual discovery of the planet from going to England, an honor it has ever since with chagrin been energetically seeking to claim.

12. Agassiz and Murray's explanation of coral reefs was vehemently scouted at first because it conflicted with Darwin's, and even now finds few supporters in England, though elsewhere generally admitted.

13. Chandler's determination of the motion of the earth's pole was violently combated by Newcomb as impossible on mechanical grounds later shown to be incorrect.

As to what constitutes proof, there is much popular misapprehension. Proof of any scientific proposition is nothing more nor less than a question of probability. Experience of nature is our only criterion of truth. The law of gravitation, which is ordinarily believed to be proved, may be so considered only in the sense that the chances of its explaining all it does would be overwhelmingly against it were it not true. Nevertheless, it has quite failed so far to account for the motion of the perihelion of Mercury—to mention only one of its lacunæ—and an objector might (and, if of the emotional bias displayed with regard to Mars, would) declare the law unproved. Only the temper of the time withholds such from doing so, although by the act they wrote themselves down as incapable of judging evidence. For none of our knowledge of the cosmos, whether of every-day acquisition or of scientific inquiry, but is based on observation, and therefore on probability alone.

The mass of evidence in favor of the habitation of Mars is so strong, that emotional prejudice can attack it only by denying the facts. Of these facts but one of many may be mentioned here, since it exemplifies the preponderance of probability spoken of. The so-called canals are straight and very narrow lines connecting little roundish spots with mathematical precision over the whole face of the planet. Observers with keen eyes and good atmospheric advantages agree in the detection. Now the chances that straight lines of the size of these should be the outcome of natural forces are millions to one, of all we know of the cosmos. But this is far from all, and is not the special point in the matter. If straight lines of the given length be thrown haphazard over a surface, which means strewn without accordance with an underlying plan, the chances that more than two will cross or meet at the same point are as one to infinity if the lines have no breadth, and one to an indefinitely great number if the lines, as in the case with canals, have no perceptible breadth.

Let us consider what the chances are that lines would exactly connect certain centers if they were not directed to that end. We will take two spots 600 miles apart as fairly averaging the Martian conditions; with the lines, the canals, 15 miles wide. Conceive, to put the case as favorably as possible for the side of natural forces, that the spots were themselves decided by explosions there giving out radiating lines. Now, what is the chance that one of these lines would hit another spot? Think of a square 600 miles in diameter about one of the spots, and take as a mean of the Martian state of things that six lines radiate from each spot; the lines being each 600 miles long and the spots equally distributed over the planet and themselves 50 miles in diameter, bearing a perceptible breadth. From the observations it is evident that if the lines did not strike the oasis or spot within 15 miles on either side the center, the inexactness would be visible. A line therefore must hit an area 30 miles across at a distance of 600 miles. Its range of variation in direction to come within the limits is therefore a little less than 3 deg. But as it may radiate out anywhere round the entire circle of 360 deg., the chance that it will strike the spot is 3/360 or 1/120. As there are six radiating lines, the chance that one out of the six does so is 6/120. Now consider a third spot equidistant from the other two. Here there are but five possible lines to strike it, one being already supposed disposed of by striking oasis number two. The chance of the third spot being hit is thus 5/120. For a fourth spot it is 4/120; for the fifth, 3/120; for the sixth, 2/120; and for the seventh, the last spot near the first in the arrangement, 1/120. That all six lines from the first spot should strike the six surrounding spots, the chances are: $6/120 \times 5/120 \times 4/120 \times 3/120 \times 2/120 \times 1/120$ or 1/24,110,000,000; that is, 24 billions to one. For the second

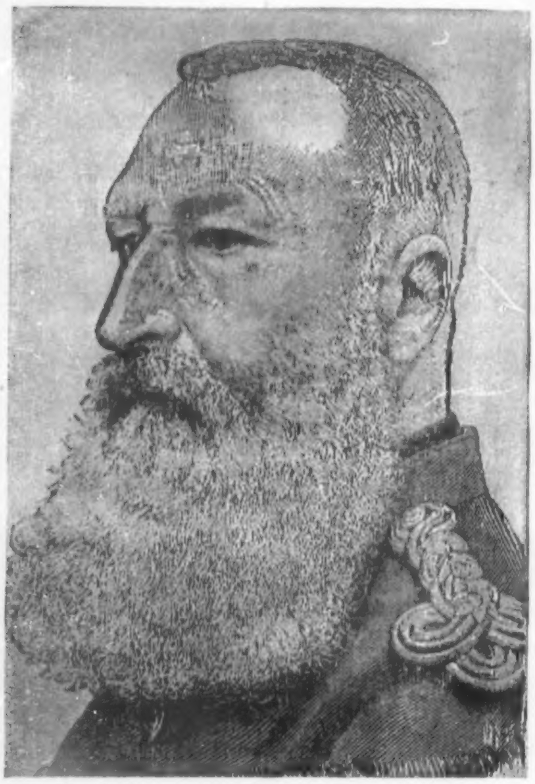
(*Concluded on page 291.*)

RECENT DEVELOPMENTS IN PICTURE TELEGRAPHY.

BY DR. ALFRED GRADENWITZ.

The telegraphic transmission of handwriting, drawings, photographs, and the like, seems now to be destined to enter the field of practical application. A few months ago we described in the SCIENTIFIC AMERICAN a system of telephotography invented by Prof. Korn, of Munich. The value of such a system for up-to-date illustrated newspapers and journals was at once appreciated by the well-known French journal L'Illustration, and the latter arranged a severe test which would demonstrate the practical efficiency of this apparatus. The test consisted in transmitting the likeness of President Fallières from Paris to Lyon and back, over an ordinary telephone circuit. The experiment proved a great success, and showed that the system can be commercially used for the transmission of illustrations. Lyon lies 318 miles distant from Paris, making the total distance of transmission 636 miles.

Although a full description of the Korn apparatus was published in the SCIENTIFIC AMERICAN of February 16, 1907, it may be well to briefly describe the apparatus as used at this test. The receiving and transmitting stations were arranged side by side, as shown in one of the illustrations. A film containing the portrait of President Fallières was mounted on the cylinder of the transmitting apparatus. A pencil of light from a Nernst lamp was focused through the film on to a prism within the cylinder and refracted to a selenium plate below. The cylinder was slowly revolved, and the light playing on the selenium plate varied in intensity, and according to the transparency or opacity of the intercepting portrait on the film. These fluctuations, by varying the conductivity of the selenium plate, according to the well-known principle, produced corresponding fluctuations or pulsations in a current going through the plate. This current traversed the course to Lyon and back to the receiving station, where it passed through a Geissler tube and produced corresponding fluctuations in a beam of light intercepted by the tube. The fluctuating beam was focused on a sensitive photographic film mounted on a cylinder which revolved at the same speed as the one at the transmitting station. In this way as the beam at the transmitting station passed through successive points on the transmitting film, the light value of these points was faithfully reproduced in reverse or negative at the receiving station. One of the illustrations shown herewith is a reproduction of a print taken from the actual negative produced.



Portrait of King Leopold.

From a block engraved by the receiving apparatus of the Carbonelle system.

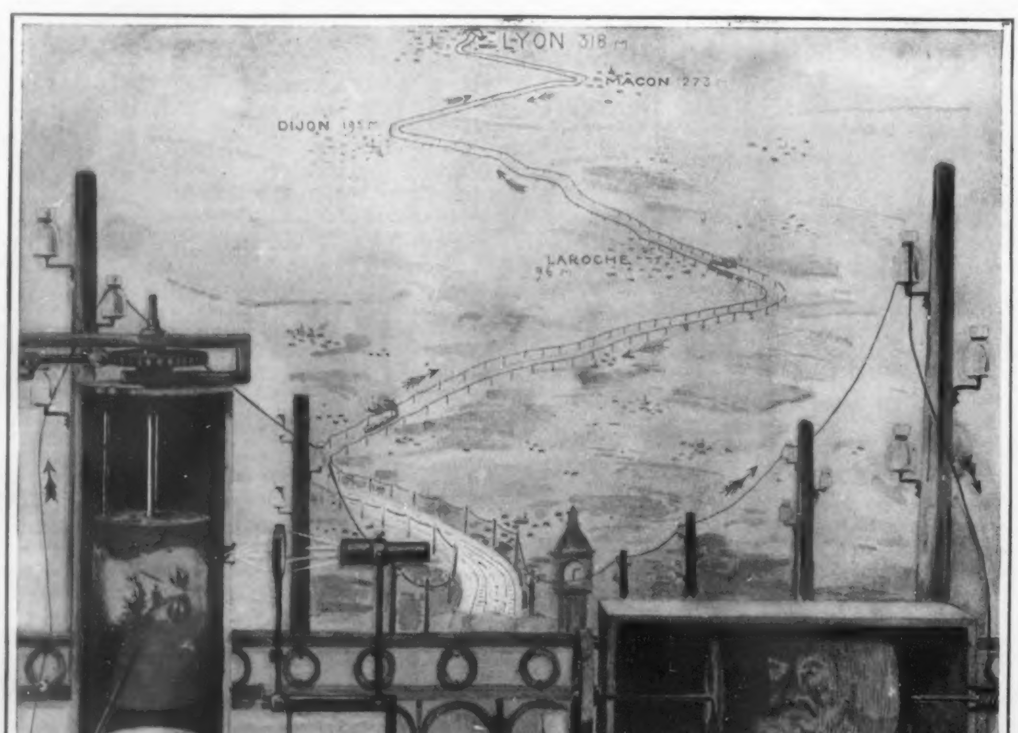
Portrait of King Edward.

From a block engraved by the receiving apparatus of the Carbonelle system.

Since the announcement of Prof. Korn's invention, several other inventors have come forward with similar systems for solving the problem of long-distance transmission of illustrations. Special interest attaches to an apparatus invented by Mr. H. Carbonelle, a Belgian engineer. This apparatus not only allows drawings or photographs to be transmitted to a distance in an extremely short interval of time, but enables a block ready for printing to be produced immediately at the receiving station.

The sending apparatus is so designed as to utilize for the transmission of pictures either the differences in electrical resistance shown by a photographic plate or film, according to the amount of metal salt present at its different points, or else the differences in the thickness of the gelatine layer of a photographic carbon print. A picture drawn with non-conductive ink on metal foil can likewise be readily transmitted. In all cases reproductions will take place at the receiving station immediately, without any developing process.

The whole plant comprises two exactly similar phonograph-like apparatus, each of which can be used at will either as sender or receiver. On the cylinder *A* of the sending apparatus, which rotates in the direction of the arrow *B*, there moves an elastic metal tracing needle or stylus *C* in the direction of the arrow *D*, just like the needle of a phonograph. The cylinder *A* is connected to one of the wires, and the style *C* to the other wire of an ordinary telephone or telegraph circuit. The receiving apparatus is exactly similar to the sender, except that tracing needle *C* is replaced by a small engraving needle *C'*, carried by the vibrating membrane of a telephone receiver.



Transmitting station. Receiving station.

Transmitting a Portrait of President Fallières from Paris to Lyon and Back.

RECENT DEVELOPMENTS IN PICTURE TELEGRAPHY.

The pictures to be transmitted may be either photographic plates containing metal salts, photographic carbon prints, line or half-tone pictures, metal foils on which illustrations or reading matter have been drawn, written or printed with non-conductive ink, and the like. At the receiving station the drawing, photograph, handwriting, etc., can be received on a layer of any soft substance such as lead, copper, tin, wax, paper, etc.

Supposing a metal foil to be used as original picture, the design to be transmitted should be fixed to the foil by means of non-conductive ink, and the foil attached to the cylinder *A* of the sending apparatus. The tracing needle must then be set at the starting point of the picture. A hollow lead or other cylinder, or else a sheet of carbon paper with an underlying and an overlying sheet of white paper should be slipped onto the cylinder *A* of the receiving apparatus. The engraving point *C'* should also be set at the starting point, and the two apparatus then set going.

With the cylinder *A*

turning round its axis, and the style *C* moving in the direction of the arrow *D*, it will be readily understood that the style should successively come in contact with all points of the original picture. Now, as the latter is made up of metal foil, covered with variable amounts of oily ink, the tracing point strikes alternately metallic spots and spots covered with ink. At the metallic spots the electric current will pass readily, while at those covered with ink the current intensity will be varied, according to the size and thickness of these spots. These variations are reproduced in the telephone receiver; the engraving

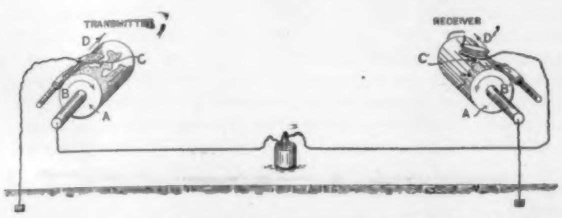


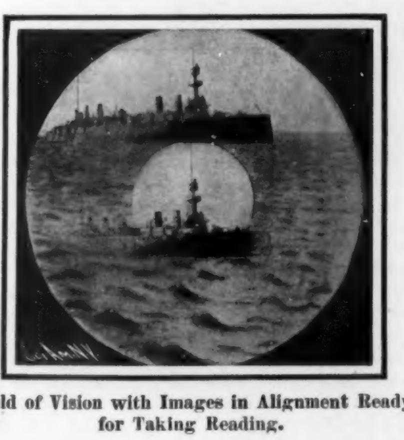
Diagram of the Apparatus Used in the Carbonelle System of Transmission.

point *C'* of the latter is made to vibrate, and penetrates into the lead cylinder whenever there is a variation in the current intensity, to a depth depending on the magnitude of the variation.

The two cylinders *A* and *A* turn at the same speed, so that the original copy is reproduced at the receiving station in all its shades. In this manner there is obtained either a metal block, that can be used immediately for printing in newspapers, etc., or else an original with carbon copy, which is immediately transmitted to the addressee.

By using a sufficiently hard point on the vibrating membrane of the receiver, the inventor has achieved the extraordinary result of engraving dispatches and illustrations directly on copper and other hard-metal cylinders. This success is of special importance for long-distance transmission of half-tone pictures intended for reproduction on a large scale in newspapers, illustrated journals, etc.

The Carbonelle process affords exceptional advantages for the telegraphic transmission of orders, checks, etc., as the addressee, in the place of a frequently unintelligible, laconic telegram, will receive a dispatch in the style of a letter, written and signed by the other party himself, which dispatch requires no



Field of Vision with Images in Alignment Ready for Taking Reading.

further confirmation and prevents any mistake or fraud. As a telegraph apparatus it is claimed that the Carbonelle system will transmit as many as 300,000 to 500,000 letters per hour, according as the apparatus is used in simple or duplex connection.

The portraits of King Edward and King Leopold which are here reproduced, were obtained directly from blocks prepared by the Carbonelle process at the receiving end of a telegraph line. The speed at which such blocks can be prepared will be inferred from the fact that the apparatus will engrave a block of 10 x 18 centimeters (4 x 7 inches) in one minute. The output is, however, doubled by duplex connection, it being possible in that case to telegraph in both directions over the same wire without any disturbance.

The Italian government proposes to adopt electric traction to a large extent upon the railroads in that country which it controls, and Parliament lately voted a credit of $10,000,000 for this purpose. Among the lines which are to be changed over may be mentioned the following: The Milan-Monza-Lecco section, which is to be an extension of the Valtellina railroad. This section, having 32 miles length, will be operated on the three-phase alternating system, and the estimated cost is $1,100,000. On the following two lines the same system will be used. The Usmate-Bergamo line, which is 16 miles long, will cost $280,000 to make the transfer. For the Calolzio-Ponte San Pietro line, 11 miles long, the cost is estimated at $100,000. These two lines are branches of the Valtellina system and will give connection between Milan, Bergamo and Lecco. Among the other lines of considerable importance are the Gallarate-Arona section, 15 miles long, costing $420,000, and the Gallarate-Laverno, 20 miles long, costing $520,000. Both these lines are branches from the already-existing Milan-Gallarate line which take the local traffic between Milan and Lago Maggiore. They will use direct current on the third rail system such as is now employed. An important section of road will be operated electrically from Domodossola to Iselle, and it will form a part of the through railroad from Milan to Lucerne, being an extension of the electric method used on the Simplon Tunnel road, and will accordingly use three-phase current. It will cost $480,000 to equip. A part of the Milan-Florence-Rome line will be equipped on the electric system between Pistoia and Porreta. This section is one of the longest, being 25 miles in length, and it is to cost $1,600,000. A still longer road is the section from Naples to Salerno, and it will be 32 miles long, costing $1,000,000 to equip.

COMMANDANT GÉRARD'S TELEMETER.

BY OUR PARIS CORRESPONDENT.

The telemeter recently invented by Commandant Gérard, of the French army, is a very useful instrument for measuring the distance from the observer to an object. Such an instrument will serve a variety of purposes which will be appreciated. For maneuver and instruction work, it serves to give the distances easily and quickly, and in actual campaign it comes into use for infantry and artillery fire. Besides, it gives a close measure of all the leading points situated in front of a defensive position.

The telemeter is formed of a cylindrical box about three inches in diameter, as shown in the engraving, upon which can be mounted an eye-glass or telescope as here represented. However, the optical principle of the telemeter is confined to the working of the lower cylindrical part, and we will consider this portion first. The two parts of the cylindrical box are made to turn one upon the other, and the movement is limited to one-half the circumference by means of a pair of stop pins on the inside. Each half of the box carries at the central part a prismatic ring, whose refracting angle is represented by the ratio 5 to 1,000. Each of the prismatic rings, which are identical, is formed by taking a very flat prism having the above angle and nearly resembling a flat glass plate, cutting it in disk form and then cutting out a central circular portion, so that it has the appearance shown in the diagram. Were the prism square, as shown by the dotted lines, its sharp angle would lie along the line *CD* and the large end along the line *EF*. Therefore the line *AB* represents the axis of the prism. Referring to the edge view, first position, supposing two prisms placed side by side with their axes *AB* and *MN* in the opposite sense. It is evident that the refractive effect of the two prisms is annulled or compensated, and the pair of prisms acts like a flat plate, giving no refraction when we look at an object through them. On the contrary, when in the second position, with the axes placed in the same sense, the refractive effect will be added and is the maximum when at this point. By rotating one or both prisms about *PQ* as an axis, we can gradually diminish the refractive effect until we bring the pair back to the first position, or zero. In other words, we have an adjustable prism which gives any refracting angle from zero up to twice the stated angle, making the total refraction 10 in 1,000.

Admitting the circular hole to be cut in each of the prisms, when we look at a distant object through the opening, it will be seen of course in its natural position. Should the two prisms now be in the contrary sense, or first position of no refraction, the effect on looking through them will be the same as if a flat glass plate with a hole in it were used. But upon turning one of the prisms about the other, a second image will appear, due to the refraction, and the position of this

The Portrait of President Fallières as Reproduced by the Kern Receiving Apparatus.

image relative to the fixed image will vary according to the amount by which we rotate the prism. The effect of such a combination is shown in one of the engravings, which represents a ship at sea when viewed in this way. Through the central hole we have the natural view. Above it is the refracted view of the ship seen through the prismatic part. The use of the telescope is not essential to the above principle, but it is needed in practice for viewing distant objects, and the result is the same.

This principle is used to estimate the distance of an object in the following way: Supposing we know approximately the value of a distant object, such as a soldier in the standing position, taking the average height. The two images of the soldier are formed in the same way as above, and the prisms are rotated until the refraction is sufficient to bring the two images just touching each other at the opposite ends, that is, with the feet of the upper image touching the head of the central image. When this is done, we have displaced the image by a distance which is represented by its length. Supposing that we had drawn two lines

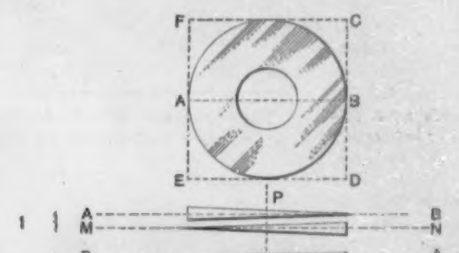


Diagram Showing the Positions of the Disk Prisms.

from a distant point to the head and to the feet of the figure, this would include a certain small angle. Knowing this angle and the height of the figure, we could calculate the distance by well-known methods. The telemeter accomplishes the same result, since we know the angle through which the prism is rotated and the height of the figure, and the operation is carried out automatically upon a set of scales. On the first scale, placed around the portion next the telescope, there are 25 divisions designated by letters of the alphabet, with the needed subdivisions. The three subdivisions lying between *B* and *C*, etc., are designated by B_1, B_2, B_3, *C*, C_1, etc. An index marked 100 is fixed on the second part and can move along this scale. Fixed along with the first part is an index *A* which in like manner runs upon the divisions of the second part when these portions are rotated. It is to be noted that in practice the two halves are rotated at the same time as nearly as possible, so as to keep the image upright in the field. When the index 100 corresponds to the index *A* the two prisms are in the maximum position of no refrac-

METHOD OF USING THE TELEMETER.

GÉRARD'S TELEMETER.

tion. On the contrary, when index 100 is opposite the scale point Z, we have the opposite position, or maximum effect, giving an angle of the ratio 10 to 1,000. In the latter position an object of one meter length is completely refracted, that is, one end of the image seen through the prisms coincides exactly with the free image of the central opening, when this object is at the distance of 100 meters from the observer. The letter Z gives the value of the cosine corresponding to a sine of one meter. In like manner the letters from Z to A give the values for the other angles corresponding to greater distances. To find the value in meters for this cosine, or in other words the distance sought, the second scale is used. It is graduated in distances from 100 up to 4,000 meters. The first disk also has a scale noting the height of the object, graduated from 0.30 up to 30 meters.

Taking an example, suppose we made the extremities of two images coincide by turning the disks, this distant object having one meter length and placed at an unknown distance. When the two disks are turned, we read the scale division opposite index 100. Suppose this to be the first division after H, or H_1. Having made the reading we continue somewhat as in taking a slide-rule reading, by turning the index A until it is opposite the graduation H_1 of the second scale. Then the whole instrument is brought so that we can read the scale of heights. Finding 1 meter height, opposite this point is read the distance sought for, or 500 meters. If the object were two meters in height instead of one, the distance sought for would be doubled, or 1,000 meters, according to the same scale readings. Taking as a standard the supposed height of a soldier of infantry corps, or 1.68 meters (5 feet 6 inches) the distance would be 840 meters (919 yards); a mounted soldier of 2.50 meters (8 feet 2 inches), 1,250 meters (1,370 yards); a telegraph pole of 8 meters (25 feet), 4,000 meters (4,374 yards), etc. All these distances are read as above opposite the corresponding heights. In campaign work, the observation is made upon objects whose height is approximately known, such as a soldier of cavalry or infantry.

As to the telescope, almost any type can be used which is appropriate for the purpose. The use of the instrument can be varied in the following way, in order to estimate the distances for artillery firing. Two soldiers are sent to a certain distance, say 1,000 meters, and they place themselves on a line facing the observer, a certain number of gun-lengths apart, with the heels joined. Such a distance can be measured quite accurately, varying from two to six gun-lengths. The observer now sees a double image of the two men, or four men, but by rotating the two disks he can bring the left-hand man (refracted image) in coincidence with the right-hand man (direct image), and he then sees but three men in the field. By the proper reading of the scales he at once finds the distance, and such a reading is quite accurate. A base of five gun-lengths or 6.50 meters (7.1 yards) gives a correct estimate for the measures needed for infantry firing practice from 650 meters (710 yards) up to 2,400 meters (2,625 yards), and the error need not be more than 25 meters (27 yards) in the latter case.

In actual campaign work, the telemeter can render great service in the estimating of distances for firing, owing to its simplicity of operation, solid construction and small size. In artillery fire it is of great value as giving the distance at once without requiring a preliminary shot, and the enemy is not forewarned in this case, thus giving a great advantage to the attacking party. In an assault upon a fixed position, the exact moment for commencing the fire is found by the observation of the distance. The value of such an instrument will thus be readily appreciated.

The earliest authoritative instance of a windmill in England was one at Bury St. Edmunds in 1191.

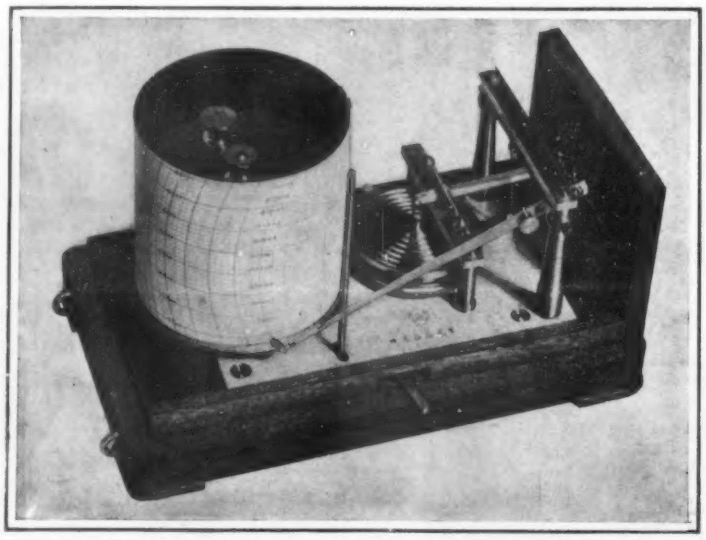
INSTRUMENTS CARRIED IN THE INTERNATIONAL BALLOON RACE AT ST. LOUIS.

Frequent reference has been made in these columns to the instruments used by balloonists to determine their altitude and also their vertical progress, whether rising or descending. The accompanying engravings show what these instruments look like, and we will endeavor to explain their operation. During the international balloon race at St. Louis, which will have been decided before this number issues from the press, each contestant will be required to carry a recording altimeter of the type illustrated. The case of each instrument will be officially sealed before the start, to prevent resetting or tampering with the mechanism. The instrument will make a faithful record of the vertical motions of the balloon, and place a check on fraud, for as soon as the contestant comes to the ground the pen will touch the zero line on the chart, marking the finish of the voyage and betraying any attempt to prolong the distance covered, by a second ascension.

The engraving shows the altimeter with the cover of the case removed. The instrument is, in reality, a recording aneroid barometer, but with a chart showing altitudes as well as barometric pressures, so that the altitude of the balloon can be read directly and without calculation. In the aneroid type of barometer, metallic chambers are used in place of a column of mercury. A pair of these disk-like chambers in superposed position may be seen in the engraving. The air is exhausted from within the chambers, which are made of very thin metal so that the pressure of the outside air will tend to compress them. Any change in air pressure will cause a corresponding variation in the compression of the chamber walls, and these variations are communicated by means of a lever to a rock shaft on which a pen arm is carried. The pen makes a record of the variations on a chart carried by a revolving cylinder. The cylinder is driven by clockwork, and in the case of the instrument here illustrated, makes one complete revolution in six hours. The chart is ruled to show the barometric pressure in millimeters of mercury from 760 to 400. On the same chart are marked the altitudes in meters represented by the variations in the air pressure. The instrument showed a range of over 5,000 meters, or more than 16,000 feet. The pen may be adjusted to allow of setting it at zero at the start of the race regardless of the barometric conditions prevailing at the time and the altitude of the starting point above sea level. A lever projecting from the front of the casing is connected with a vertical wire bearing against the pen arm. By operating this lever the pen may be withdrawn from the chart, when it is desired to discontinue the record.

When one is floating in the air at a short distance above the ground he is too far removed from any reference points to determine whether his balloon is ascending or descending. In the earlier days of ballooning bits of paper or chaff were thrown out of the car and by their apparent rise or fall the vertical motion of the balloon was judged. But this was very unsatisfactory as it did not allow for currents of air which might carry the chaff up or down. The ordinary barometer is not sensitive enough to record a slight rise or fall, but a special instrument called the statoscope has been made to meet this demand. It consists of a cylinder in which are a series of connected chambers of the aneroid type. The air in these chambers is not exhausted, but they are in communication with the outside air through a pipe which passes through the cylinder. By means of a rack and pinion, the slightest extension or compression of the series of chambers is communicated to an indicator needle. The cylinder communicates with the free air by means of a flexible rubber tube, and as long as this is open, the pressure within and without the chambers remains equal regardless of the rise or fall of the balloon, and the needle continues to point to zero. If, however, the balloon be rising and the rubber tube be pinched, the air in the cylinder will be trapped, and as its density is greater than that of the air above, with which the interior of the chamber communicates, it will tend to compress the chambers and thus turn the needle toward the right. If the balloon be falling the reverse takes place, the difference in pressure of the trapped air and free air causing the needle to move toward the left. The button at the right permits of adjusting the needle to the zero position. So delicate is this instrument that it will detect a rise or fall of three feet, and by noting the time it takes the needle to move over a graduated arc, the rate of vertical motion can be determined. If a stop cock were used in place of the rubber tube, the aeronaut might inadvertently leave the cylinder closed while moving through a wide range of barometric pressure, and this would injure the delicate mechanism. In order to protect the instrument against changes of temperature, it is incased in heat-insulating material. This also protects it in case of accident to the balloon.

The Statoscope, With Which the Rise or Fall of a Balloon Can Be Detected.



The Altimeter, an Instrument Like the Barometer, Which Records Vertical Movements of the Balloon.

INSTRUMENTS CARRIED IN THE INTERNATIONAL BALLOON RACE AT ST. LOUIS.

Chemical Experiments in Fertilization.

Prof. Loeb, of the University of California, in a recent address at Boston upon the subject of fertilization, detailed his latest conclusions, the result of experiments with the unfertilized eggs of star-fish, sea-urchins, and other low types of marine life. By chemical means in the laboratory he was able to awaken the dormant powers of development in unfertilized eggs, and also to cause a membrane to form about the egg, a frequent incidental accompaniment of fertilization. The treatment with fatty acids, alkalies, and fat solvents followed by immersion in concentrated sea-water containing oxygen led to apparently normal development of the eggs. The acids, alkalies, and fat solvents act on the fats of the egg and start oxidation; the concentrated sea-water regulates and normalizes these processes. The formation of nuclear material results, and once begun this material reproduces itself automatically. These researches indicate an important part played by oxygen, and show that the sole object of oxidation is not, as is still taught, the production of heat.

The goal of research in this field of investigation is the method of the formation of nuclear material. When this is understood, it will be one step toward the solution of the interesting question as to whether or not it will ever be possible to produce living from inanimate matter.

Dr. Wiley, the chief chemist of the Department of Agriculture, is endeavoring to learn the wholesomeness of so-called "soft drinks." The inquiry is the result of a request from the War Department for information regarding the different varieties of aerated drinks that are sold at army canteens. Dr. Wiley will select a class of young men upon whom he will experiment with the drinks usually sold at soda fountains and in "pop" bottles to determine the effect, whether deleterious or otherwise. A soda fountain will be installed at the Department of Agriculture to furnish the requisite fizz water for the class, which will begin next month with the free soda water. The result of the experiments will be turned over to the War Department and will also be made the subject of a report by Dr. Wiley to the Secretary of Agriculture.

Correspondence.

The Scientific American Trophy.

To the Editor of the SCIENTIFIC AMERICAN:

Permit me to voice my hearty appreciation of the beautiful aeronautical trophy which you have so kindly donated. As a member of the Aero Club of America, and one interested for many years in the science of aerial navigation, and as a friend and warm admirer of the late Samuel P. Langley, I wish particularly to express my appreciation and satisfaction of the manner in which you have identified his name and most important work with the trophy which has been prepared under your auspices.

WILLIAM J. HAMMER.

New York, October 14, 1907.

The Hudson Celebration.

To the Editor of the SCIENTIFIC AMERICAN:

Your editorial note on the Commission's suggestions of Hudson celebration suggests that "the civic pride of various communities along the river be invoked to participate in like manner according to means." This gives rise to a further suggestion, that old home weeks be observed by the towns of the river counties. The Hudson east shore counties contain the oldest homes of thousands and thousands of families now in other parts of the State or scattered all over the West. It would even be fitting to carry forward the plans and preparations next year for family celebrations, the erection of memorials, and the completion of histories and genealogies.

Clyde, N. Y. W. L. DEVEREAUX.

Three Apple Crops in One Year.

To the Editor of the SCIENTIFIC AMERICAN:

Silas Obenchain, sheriff of this county, has a Siberian crab-apple tree that was transplanted last fall, that has now on its branches three crops of maturing fruit. It bloomed in April, July, and September. The tree is small, but is full of fruit of three sizes.

I see by a local paper that V. H. Rees, of Collinsville, I. T., has an apple tree of the early June variety, from which he gathered an excellent crop about July 1. The second blossoms made their appearance July 10, and early in September the tree has bloomed for the third time. He transplanted the tree about a year ago, when it was five years old.

I have known fruit trees to bloom the second time and bear the second crop in one season, but these are the first instances where I have known trees to bloom and form the third crop in the same season.

Klamath Falls, Ore. F. M. PRIEST.

A Suggestion to Aeroplane Experimenters.

To the Editor of the SCIENTIFIC AMERICAN:

I am deeply interested in aerial navigation, and have wondered why advantage is never taken of our immense snowdrifts in the Rockies, as a means of giving momentum to aeroplanes and confidence to their drivers. I have seen men on skis jump eighty to one hundred feet and land in safety; and I have thought that if an aeroplane gained its momentum in the same way, the presence of deep soft snow to light in would give the aeronaut more confidence.

For years I have watched through a pair of good glasses the flights of large birds, such as buzzards or eagles. It has been contended that they soar without any movement, but I have noticed that they take advantage of different air currents. For example, a bird 1,000 feet in the air in a current blowing north, and with another current 200 feet lower blowing south, will with outspread wings drop with great velocity from the higher to the lower current. It seems the momentum acquired by gravitation when directed against the wind will bring the bird back almost to its original altitude.

C. C. SMITH.

Douglas, Ariz.

The Quebec Bridge Disaster.

To the Editor of the SCIENTIFIC AMERICAN:

In reading your account of the Quebec Bridge disaster, it occurred to me that if the compression members that buckled had been filled with cement or concrete, they would likely have stood the strain. It seems to me that if I understood figuring such things, I could devise some system of reinforced concrete that would hold the steel more rigid, and prevent the buckling to which you ascribe the fall of the bridge.

I should start with the simple proposition to use continuous cover plates instead of lateral bracing, and fill inside with cement or concrete. Possibly use the present form of lateral bracing, with cement both inside and outside, and a temporary mold on the lower side during construction.

Probably a bridge builder would modify my suggestions considerably, but if there is any good in them you are welcome to them. R. B. SPURGIN.

Arlington, Texas, October 2, 1907.

[The use of concrete in the manner suggested above would entail the addition of too much weight. Ample stiffness could have been secured in the compression members of the Quebec bridge by the use of cover plates in place of latticing, and the insertion of longitudinal and transverse diaphragms between the four ribs of the chord.—ED.]

Effect of Ambrose Channel Upon the Other Waterways in New York Harbor.

To the Editor of the SCIENTIFIC AMERICAN:

Apropos of the opening and continued enlargement of the new ship channel across the vast shoal in lower New York Bay, it becomes an interesting speculation as to its effect in the way of a readjustment of the natural conditions in the waterways contiguous to New York above and below this channel. A direct passage 40 feet deep and nearly half a mile wide (2,000 feet) will be one of no mean proportions, and may be expected to materially accelerate the currents in and out at each tide through the East River, Hell Gate, and the North River, on account of the more prompt delivery of the tidal flow. It will doubtless have the effect of decreasing the rate of flow through the longer and more circuitous old ship channel in the lower bay, and possibly to the extent of permitting a gradual deposit of silt that will ultimately make dredging necessary to maintain its present depth. A readjustment of the sands to seaward of the outward end of the new channel may also take place, whereby the present channels not in the direct line of the new flow may not be kept open naturally as at present. This would probably be in the way of cutting away some of the bars in line of the new flow, and dropping the material in the contiguous deeper channels. In time this could easily result in a much wider outside channel of less general depth, and possibly in time to less than 40 feet. The speculations of your "Tidal Expert" on this subject will make an interesting article in the columns of the SCIENTIFIC AMERICAN. F. N. TREVOR.

Lockport, N. Y., October 10, 1907.

THE EVIDENCE OF LIFE ON MARS.

(*Continued from page 287.*)

spot, which has three tentacles still free, the chances that it will similarly connect with others is $3/120 \times 2/120 \times 1/120$; so that the first fraction must be further multiplied by this one, and so on for the other spots. Now, when we reflect that 200 spots more or less are connected in this manner, the absurdity of the lines being radiations dawns upon us. For the chance that 200 spots should be thus interconnected is $(3/120 \times 2/120 \times 1/120)^{200}$, or as one to sixteen with 259 ciphers after it! For this reason no mathematician could for a moment suppose them to be cracks, but unfortunately most laymen and many astronomers, contrary to popular misapprehension, are not mathematicians.

Reversely, this enormous number to one is the chance that the lines are the outcome of a definite underlying plan not due to natural causes, unless we suppose natural causes of which we have no cognizance, and therefore no specific right to call in. The whole aim and action of science is to explain; it is only nescience that summons the unknown to its aid. But here we have an explanation at hand able and sufficient, to wit: local intelligence on the planet directing the position of these lines. This takes the place in our present inquiry that the law of gravitation does in the movement of the planets, and in both the mathematical chances in its favor are so overwhelming as to constitute what we mean by saying a thing is proved. I have mentioned here but one line of evidence; many more will be found in "Mars and Its Canals," all converging to the same conclusion. No assumption of life is made there, but preponderances of probability are massed one upon another to show it, which is precisely what we pronounce proof.

Death of Enos Brown.

Enos Brown, San Francisco representative of the SCIENTIFIC AMERICAN, was taken violently ill while seated at his desk on the evening of October 11, and died about twenty minutes after six, shortly after the attack.

Mr. Brown was born in New York State some sixty years ago. In 1886 he began newspaper work in San Francisco, and after serving on several other journals, became the representative of the SCIENTIFIC AMERICAN on the Pacific coast, in which capacity he served until a year ago. In him were combined integrity with geniality, and scientific attainment with stable practicability.

Eradication of Birthmarks by Radium.

Birthmarks, which have always been considered as indelible, are now said, on the authority of two Paris physicians, to yield to the action of radium. The new method has proved equally successful in the cases of adults and children.

The marks are effaced by the simple application of a plane surface covered with varnish containing radium. The action is regulated by the length and frequency of the applications. The applications are said to be painless. The treatment may be applied to an infant during sleep. The doctors add that the birthmarks most easily cured are those which are most highly colored.

Cook's Polar Expedition.

Dr. Frederick A. Cook is at present at Etah, Peary's base in North Greenland, and proposes to make a winter dash for the Pole. This expedition is in marked contrast to many which have set out for the same objective. Dr. Cook is attended by only one man, a cook, and his expedition is said to be an afterthought, he having resolved on making the attempt while on a pleasure cruise in the North. His plan is to stay at Etah until December, until the ice pack becomes well hardened, then dash along the pack. When open water is met he will cross it in two canvas boats. Dr. Cook will take but a few Eskimos and dogs and will relay them in stations all the way. He will take substantially the same route as Peary.

Capt. Bartlett, the sailing master of the craft which conveyed Dr. Cook to Etah, says that a fine lot of dogs are available. To reach the Pole and return in safety, Dr. Cook must cover about one thousand miles—a dangerous trip in the winter season.

The Current Supplement.

After having been lost to the world for nearly thirteen centuries, the sacred city of Abu Mina, the shrine of Saint Menas, has been found. This interesting discovery is entertainingly described by E. Alexander Powell in an article which bears the title "An Egyptian Lourdes." "Fishes That Hatch Their Eggs in Their Mouths" is the title of an article which tells much which is curious and new. The pineal eye, the pineal gland, and the pituitary body, although they have been studied chiefly in the human subject and from a medical point of view, are not peculiar to man, but are found in all mammals. These three brain appendages, which after being long neglected by entomologists and physiologists are now attracting a good deal of attention, are described in untechnical language. The solar radiation which maintains life upon the earth produces on our senses impressions comparable with the effects of artificial sources of heat and light. Hence, astronomers and physicists have been led to seek a measure of calorific power of the sun by comparing the heating effects of its rays with that of a source of heat whose intensity can be measured directly. An account of these experiments is given by A. Millochau, who is assistant professor at the Meudon Observatory, which makes a specialty of solar physics. G. R. Agassiz tells now observations of Mars are made at Flagstaff, where Prof. Lowell has discovered so much about our planetary neighbor. The steel steam collier "Malden," recently built at the yards of the Fore River Shipbuilding Company, marked the addition to the United States merchant marine of one of three vessels destined, it is believed, to revolutionize the tidewater coal-carrying trade of the Atlantic seaboard. The vessel is described and illustrated in the current SUPPLEMENT. The ninth installment of J. H. Morrison's interesting treatise on the development of armored war vessels is presented. In this installment the Crimean war and early foreign armor are discussed, as well as the ironclads of the Union navy during the civil war. Walter J. May gives some practical information on brass waste in machine shop and foundry. A third installment of Prof. Watson's Elements of Electrical Engineering is published. In this installment the arc-light dynamo is simply described. Henry L. Gantt contributes a thoughtful article on the economical utilization of labor. Bertram Boltwood writes on the origin of radium.

The St. Louis Balloon Race.

At the time of going to press it is stated that J. C. McCoy and Capt. Charles De F. Chandler, of the United States Signal Corps, have won the Lahm cup, although no definite news of their alighting had been received. Their balloon, however, was seen near Point Pleasant in West Virginia, 502 miles distant from the starting point as the crow flies, so that the trophy is theirs without question.

The ascension was made from St. Louis on October 18, for the purpose of testing the sustaining powers of the gas to be used in the international contests which begin on Monday.

Fortunately, provisions were taken as a safeguard, in spite of the fact that the trip was not undertaken with the intention of trying for a record. The aeronauts passed over the States of Illinois, Indiana, Ohio, and part of West Virginia.

The world's balloon record, which has stood for seven years, was established in 1900 by Count Henri Delavaux, who covered 1,300 miles, from Paris into Russia, breaking the record made on July 1, 1859, by Prof. John Wise, who covered a distance of 1,150 miles, from St. Louis to Henderson, N. Y.

WHEEL SKATES FOR USE ON ORDINARY ROADS.

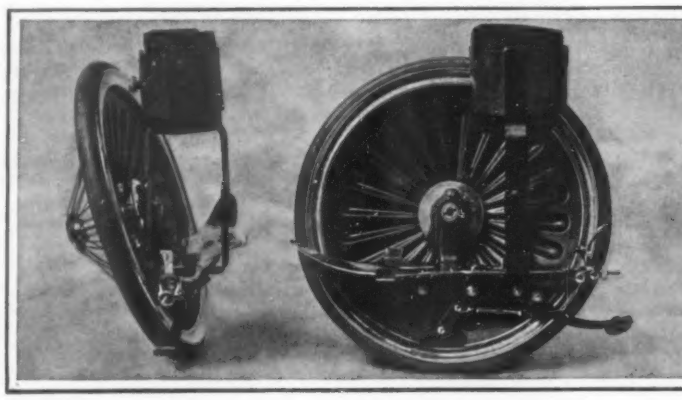
BY OUR BERLIN CORRESPONDENT.

Attempts have been made from time to time to extend the sport of skating to ordinary smooth roads. The reason that roller skates cannot be used on macadam roads is because the rollers are of such small diameter that they drop into every depression and unevenness of the road and check the progress of the skater.

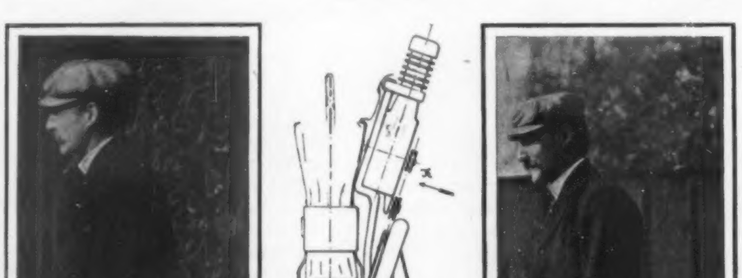
What is necessary, then, is a skate with large wheels. But these, if placed directly under the skater's feet, will raise him dangerously high. However, the difficulty seems to have been solved by a Swiss inventor, Mr. M. Koller, of Winterthur, who has designed the skate shown in the accompanying illustrations.

It will be observed that the skates are each provided with a single wheel which is about a foot in diameter. The skater's foot is supported below the center of the wheel, and in order that the tread may come directly below the center of the skater's foot the wheel is set on a slant. The wheels are dished, comprising a disk of corrugated metal connecting the hub with the rim, and also a series of tension spokes which serve to stiffen them. The foot support is suspended on a hanger attached to the wheel axle, and it is provided with a pair of braces extending upward to support a strap which is fastened around the skater's leg above the ankle. To prevent the wheels from rolling backward a brake is attached to the foot support and bears against the inner periphery of the wheel rim. This brake is normally out of action, but is automatically set as soon as the wheel starts to reverse its direction. If desired, this brake may be thrown out of action completely to permit the skater to perform various fancy figures.

In addition to the brake just described, the wheel for the left foot is provided with a rearwardly-extending arm which the skater may use as a drag to retard his motion. The wheel for the right foot is provided with a similar drag arm which also has in connection with it a brake block that bears against the inner periphery of the wheel when the drag arm bears against the ground, thus furnishing the skater with a quick-acting brake for use in emergencies. One of the illustrations shows this brake in use. The inventor also proposes to use a motor in connection with each skate wheel, which will be attached in the manner indicated in the diagram. The wheel will be driven by belts running from the power shaft of the motor to a pulley groove on the felly of the wheel. Fuel for the motor can be supplied from a tank strapped to the back of the skater. It is claimed that wheel skating can be learned in a very short time, beginners having acquired the knack of using them with safety in a few minutes.



The Construction of the Wheel Skates.



Skate Wheel with Motor Attached.

On Level Ground; Brake Lifted. Traveling Downhill; Brake Applied.

WHEEL SKATES FOR USE ON ORDINARY ROADS.

The Flea a Disease Carrier.

The California flea will be examined by the Department of Bacteriology of the State University of California, to discover if this insect, like the mosquito, propagates disease. Fleas and rats on the ships that come into the port of San Francisco from the Orient seaports, where a plague is known to prevail, will be collected by the university students, taken to the laboratories at the State institutions, examined, and classified. The work will be carried on along the same lines as the government's labors with the mosquito. Believing that rats are also carriers of contagious diseases, the city authorities of San Francisco have declared an open war against them. It is determined to exterminate these animals. Along the miles of water front and in cellars, basements, and old buildings, these animals fairly swarm, and are a great menacing pest. Every expedient will be used to destroy these creatures root and branch; for it is the strong belief of medical men that they help to distribute contagious germs.

Rumors of disaster seem inevitable in Arctic exploration. Last week we referred to the probable loss of W. S. Bruce, who was prospecting for coal fields in eastern Spitzbergen. There was strong presumptive evidence that he and his companions had been lost, but word now comes of their safety.

NEW EUROPEAN FLYING MACHINES.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

An aeroplane which has many novel features, both as to the general form and principle of flight adopted, and also as to the method of constructing the framework, has recently been constructed by Capt. Ferber. We have already had occasion to illustrate the previous work of this distinguished aeronaut, and it will be remembered that he was one of the first to take up the study of the subject in France, having made many experiments with different forms of apparatus. Recently he recommenced work in this direction, and the result of his researches is embodied in the present form of flyer, which we illustrate here. He first made a model on a reduced scale in order to test the stability of the system in the air. This model is represented in one of the engravings in flight. Capt. Ferber then set about constructing an aeroplane on a large scale, and this work is now going on at Le Perreux, in the suburbs of Paris. Curved surfaces will be used for the wings. As to the general form of the flyer, it consists of a straight body of considerable length to which are joined two wings and a flat tail. The whole has the general appearance of a flying bird, even more so than is usual in the recent aeroplanes which we have seen in the vicinity of Paris.

The body of the flyer is formed of a simple and light frame of wood, which has a triangular section with the apex of the angle at the bottom. A canvas covering is placed upon the frame. In the rear end the tail, which is a simple canvas-covered frame, is placed horizontally. It has somewhat the form of a bird's tail. It is not movable, however, but is attached rigidly to the main body. A curious form of rudder is placed in front, following the Wright brothers' plan. There is a plane frame attached to the body and on each end of it is a smaller frame which is movable and is controlled by a set of cords. By working the frames properly, the aeronaut is able to steer the flyer up and down in the air, or else to trim it laterally. As to the details about the propellers and motor, we must wait until the actual apparatus is constructed. That the flyer is making progress will be seen in the views of the wings, which are now well under way. Capt. Ferber has some original ideas about the method of constructing the wings. Because of their curved form he wished to dispense with all brace wires such as are commonly used for stiffening the frames of aeroplanes. One of the views shows the wing in the first stages of construction. The edging which runs around the wing has a somewhat parabolic form, and is made of aluminium. From side to side are placed a series of trusses, each of which is made up of two light curved strips of ash braced across by short pieces. The strips are given the proper curve above and below, which determines the general curved surface of the wing. Over the curved trusses are placed a series of very light wood strips which run longitudinally. To complete the frame, the under surface carries a series of transverse strips, which are added here so as to give a good support for the canvas at the bearing surface. The wood strips are joined in the frame with special precautions by means of aluminium corner pieces and binding cord. Upon the flyer, which is known as the "Antoinette," will be mounted a light-weight motor of the same name. The new 100-horse-power motor is to be used here. It will be connected with a propeller which is to have 2.40 meters (7.9 feet) total diameter. Counting motor, propeller, saddle and wheels, and aeronaut, the total weight of the flyer will be nearly 500 kilogrammes (1,100 pounds). In the new 100-horse-power "Antoinette" motor, M. Levavasseur has succeeded in reducing the weight so as to obtain one horse-power per kilogramme (2.2 pounds), which is a remarkable figure. Capt. Ferber expects to be ready before long to make a trial of the new flyer upon the Issy grounds near Paris.

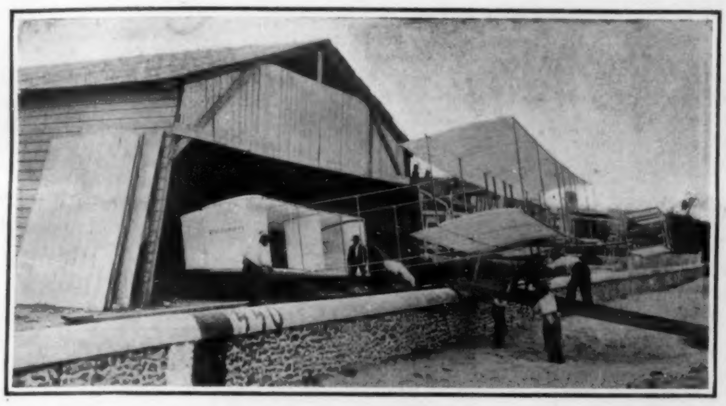
Henri Farman, the well-known chauffeur, has now turned his attention to aeroplane work. As will be noticed in the different views of his new aeroplane, it is built on the cellular plan and contains two main bodies joined together, with a smaller one in front. Although different in many points, the general idea seems to be inspired by Santos Dumont's aeroplanes. The present apparatus is built by Voisin Brothers, who also constructed the Blériot apparatus. M. Farman has set up a balloon shed upon the Issy grounds in order to house his new machine. As to the leading details of the aeroplane, we may mention that it contains a front cell with double canvas-covered plane frames superposed. The two planes, which have specially curved surfaces for striking the air, are spaced 1.50 meters (5 feet) apart. The cell is 10.2 meters (33.6 feet) in length and 2 meters (6.6 feet) wide. A light framework connects the front part with a somewhat similar piece in the rear of the flyer. The distance apart is 4.50 meters (14.9 feet). The second cell is somewhat different from the first, inasmuch as it is closed at the ends and has also a vertical partition in the middle. About 6 meters (19.8 feet) is the total length of this part, and the width is the same as for the front piece. The rear cell has also inclined and curved surfaces. In the front of the flyer is a smaller piece which serves as a rudder for vertical steering, and it is formed of two canvas frames joined together. Connecting the rudder and the front body is a double-pointed skeleton beam of light wood strip. It serves as the main supporting piece of the flyer, and is mounted upon a pair of wheels so as to allow the flyer to light upon the ground under the best conditions. The rear member also carries a pair of small wheels, so that the whole apparatus can run upon four wheels when upon the ground. The trellis-work frame or beam carries the pilot's seat, together with the motor and propeller. As to the motor, it is of the 50-horse-power type and is connected to a propeller which has 2.10 meters (6.9 feet) diameter and 1.10 meters (3.6 feet) pitch. The total carrying surface of the aeroplane is figured to be 52 square meters (561 square feet) and when mounted by the pilot the total weight is 500 kilogrammes. With the present apparatus, M. Farman expects to make a speed of thirty miles an hour.

On October 15 Farman succeeded in driving his aeroplane a distance of 285 meters (918 feet) through the air, thus breaking the French record of 220 me-

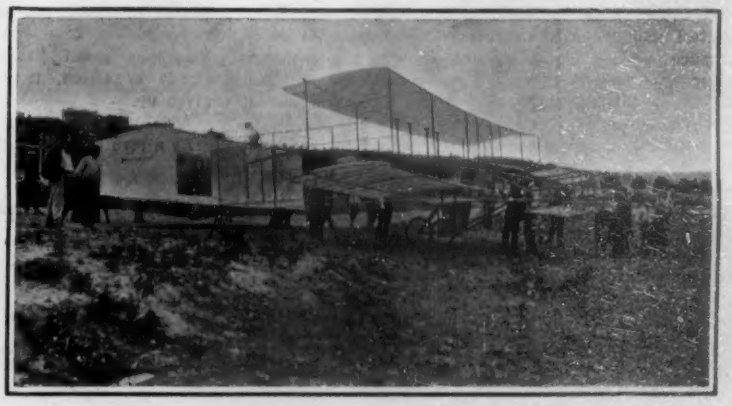
ters (721.6 feet), held by Santos Dumont. The flight was witnessed by a large crowd, Farman sailing over the heads of the spectators at a height of 38 feet.

Only the houses on the outskirts of the Military Parade Grounds, where the trial was undertaken, prevented him from making an even longer flight. The machine, traveling at a speed of twenty-five miles an hour, was brought easily to the earth, only one of the wheels being slightly bent. Farman throughout the trip maintained perfect stability.

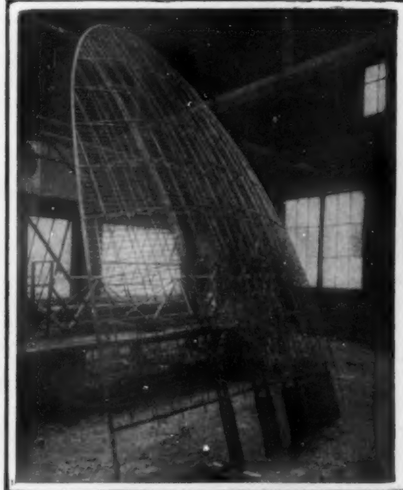
After a few preliminary runs against the fresh



Farman's Aeroplane Leaving Its Shed.

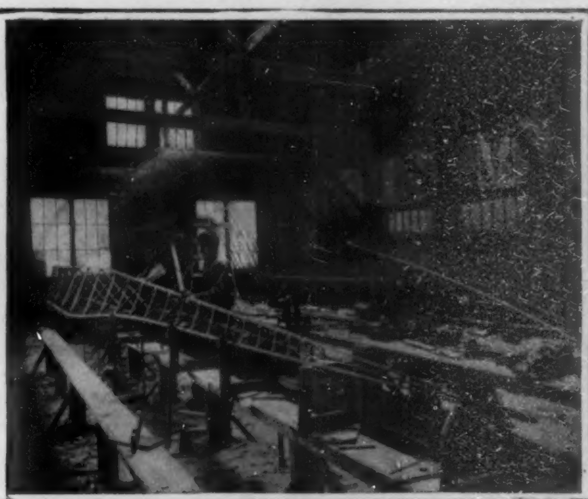


Farman's Aeroplane Just Before the Start.

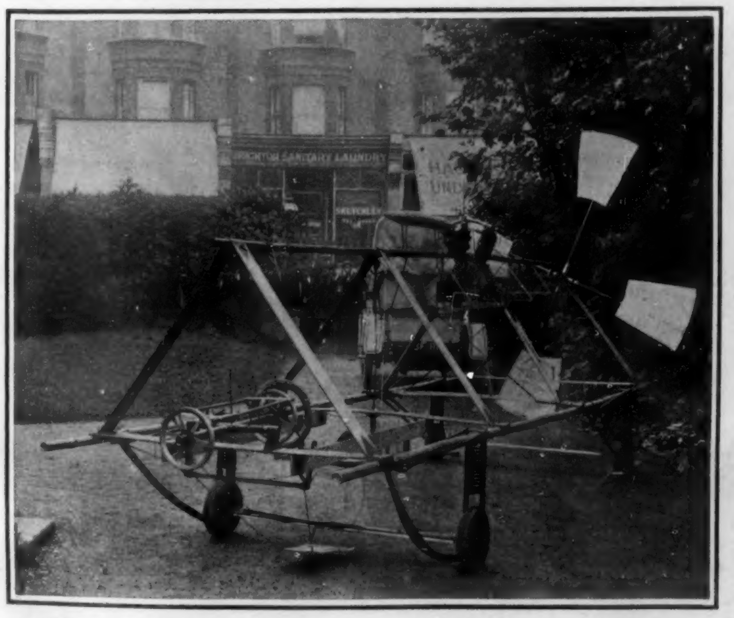


One of the Aerocurves in Course of Construction.

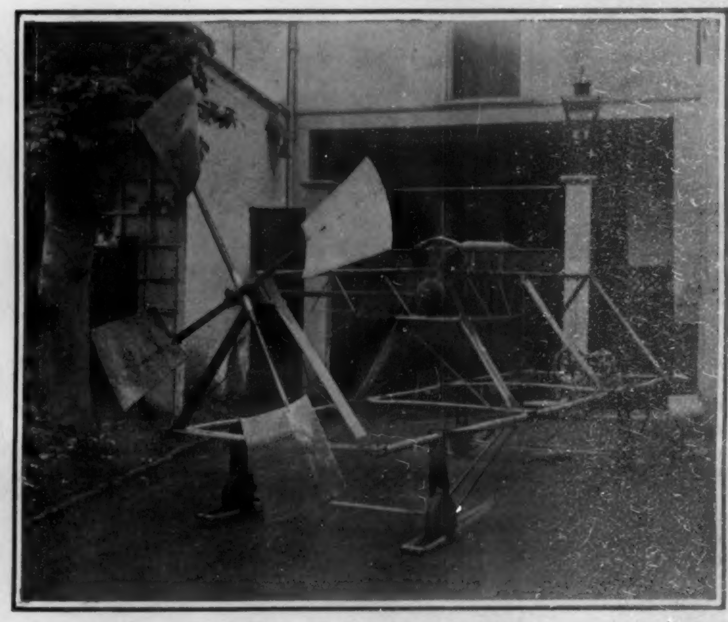
Captain Ferber's Model in Flight.



The Tail of the Machine in Course of Construction.



Roe's Flying Machine From the Front. The Aeroplanes Have Not Been Attached.



Roe's Flying Machine From the Rear.

NEW EUROPEAN FLYING MACHINES.

southwest wind, Farman set his 50-horse-power motor at full speed, and the machine soon was scudding along at a rate of twenty miles an hour. After a run of only 300 feet, Farman raised the front horizontal rudder to a slight angle and the apparatus slid easily into the air at a height of 38 feet. He again adjusted the rudder so that he maintained the 38-foot height throughout almost the entire distance.

There will shortly be put to a practical test on the Weybridge motor racing track in England a full-size aeroplane which has been erected by Mr. A. V. Roe, the winner of the recent model flying-machine competition held in London. At this exhibition Mr. Roe exhibited a model of a man-carrying aeroplane, or rather avroplane, a name coined by its inventor.

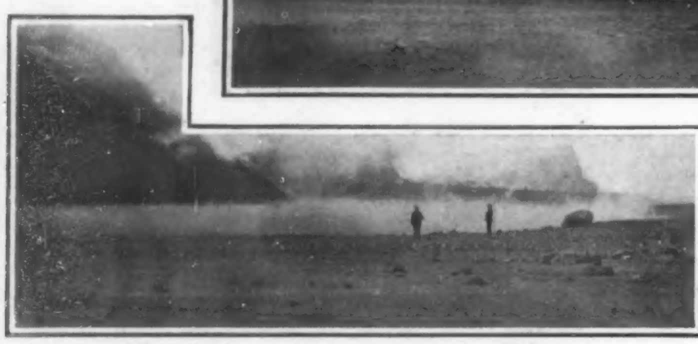
As a result of his experiments with models, Mr. Roe has now built, almost entirely with his own hands, a 36-foot man-carrying aeroplane. The machine has been erected in the shed of a private house in Wandsworth, South London, and is now practically completed. Completed it will weigh about 450 pounds, including the aeronaut, and have 480 square feet of surface, or slightly less than one pound per square foot of supporting surface. It is designed to travel at 40 miles per hour, and should rise at 25 miles per hour. The motive power is a 6-horse-power engine weighing but 48 pounds, or a total average weight of 75 pounds per horse-power. Prof. Langley has proved that a 1-horse-power engine can carry 208 pounds through the air at 40 miles per hour, so a 6-horse-power engine should suffice in lifting a 450-pound machine and driving it at a good speed. In view of the fact that every man-carrying model which has hitherto flown has required anywhere from 16 to 50 horse-power, it is doubtful if any such speed as 40 miles an hour will be attained.

The main longitudinal members of the carrying frame of the machine consist of light bamboo. It is 16 feet long over all, and about 4 feet 6 inches in height. It runs on four little pneumatic wheels, each 10½ inches in diameter. Above these are large spiral springs to prevent shocks in descent, and also to keep the machine intact should it strike the ground sharply. It is Mr. Roe's belief that many machines which have come to grief in their descent could have been saved if care and judgment had been used in designing the framework. Naturally, it adds to the weight of the apparatus, but it is the designer's contention that a little extra weight is better than risking a possible destruction of the machine. A pressure of 150 pounds must be exercised before the various springs are called into play. Every portion of the apparatus is shaped to offer very slight resistance to the air, the frames being made from 3¾-inch by 5/16-inch pine. The whole is well braced up, and has been tested to with-

stand more than twice the strain in the air. The steering gear is decidedly ingenious, and is Mr. Roe's own invention. In design it resembles an ordinary motorman's wheel, and by it the aeronaut in his seat, in a suspended boatlike chair, can steer the machine. For vertical steering the gear is rocked, which moves the front plane to which the steering gear is attached up and down, and for lateral steering the wheel is turned in the usual way, which raises one side of the front plane while the other is lowered. Hitherto the tilting of a machine to right or left, necessary to keep it balanced in the air, has had to be performed by separate wheels or levers. The propeller is made of steel and magnalium, a metal slightly lighter and much stronger than aluminium. It has a total diameter of 6 feet 10 inches. There are four blades, but they are detachable, so only two may be used if desired.

The actual aeroplanes, which, of course, are not seen in our photograph, consist of five open boxes, covered with very light canvas. The two main planes are 36 feet and 30 feet in length respectively by 5 feet 4 inches in width. There is a space of 8 feet between the front and rear planes. These aerocurves have hard cutting edges and ribs, the under surfaces being perfectly smooth and free from obstruction of any cross members.

Summit of McCulloch Peak.



Steaming Lake, Fire Island in the Distance.

THE BOGOSTOFF GROUP OF ISLANDS—HOW THEY WERE CAST UP BY THE SEA.

Of the greatest scientific interest is the account of the exploration of the recently-formed peaks in the Bogostoff group of islands. In June, 1906, there was a volcanic disturbance in the northern Pacific, and a new island was forced out of the sea by the explosion. The revenue cutter "Perry" arrived in the vicinity within a very short time after the upheaval, and her officers and crew were actually able to watch the growth of the new land as it rose steaming from the sea. It was named "Perry Peak," in honor of the vessel.

In speaking of Bogostoff Island, the report says that in general it is a barren stretch of land, extending approximately two miles in a southeasterly and northwesterly direction, with a maximum width of approximately three-quarters of a mile. The character of the ground is very broken, consisting of jumbled, irregular masses of disintegrated rock—basalt, feldspar, scoria, tufa, pumice, obsidian, trachyte, and other igneous rocks—and volcanic mud, all more or less discolored with a deposit of sulphur. The obsidian noticeable in the sand on the beach is in a finely-divided form. Steam is present nearly everywhere in dense clouds, and sulphur vapors are sufficiently dense to be unpleasant. On July 4 last a party from the revenue cutter "McCulloch" made an exploration of the formation, landing near Fire Island, of the Bogostoff group. At the point where the explorers set foot on the soil of McCulloch Peak, they found numerous rents giving off steam and sulphur fumes, discoloring the rocks.

A steaming lake was also found at this point. It is approximately 1,200 feet long by 100 feet wide, but of no great depth, so it will no doubt dry up within a short time. An attempt was made to ascend the peak, but owing to the danger of avalanches and asphyxiation, and to the hindrance given by the clouds of steam, it was given up.

RECENTLY FORMED ISLAND IN BOGOSTOFF GROUP. PERRY PEAK ON THE LEFT; M'CULLOCH PEAK ON THE RIGHT.

As a result of the Postal Union Congress held at Rome in 1906, when international postage stamps were authorized, France issued an international postage stamp on October 1, and it is expected that a British stamp will also be issued. The stamp can be sent to most of the countries in the Union to prepay a reply to a letter, and also in payment of small accounts (up to 20 cents). Orders for four million stamps were placed, and if the experiment is a success the issue will be continued.

Ammonia from Peat.

A new English process for obtaining ammonia from peat is described by Consul Halstead, of Birmingham. A great difficulty in the commercial utilization of peat has always been the large amount of water it contains, which averages 90 per cent. To eliminate the existing moisture down to 70 per cent is a comparatively simple matter, but to reduce the moisture to a degree where the peat can be utilized for fuel is a long and expensive process.

The Woltereck process has at last overcome this difficulty. By this new method it has been finally determined on a manufacturing scale that a minimum yield of 5 per cent of sulphate of ammonia is obtained from the peat, calculated as theoretically dry. The chief products of the Woltereck process, namely, sulphate of ammonia and paraffin tar, have a practically unlimited market, and the market for acetic acid, acetates, and their derivative—acetone—is continually expanding, especially that of the latter, of which enormous quantities are required by the manufacturers of smokeless powder. In addition, the ash of peat is salable to the farmer as a cheap fertilizer, since it contains potassium salts, lime, and phosphoric acid in available form. After the peat has undergone the necessary harvesting it is conveyed to the works and automatically fed into hoppers working with compressed air and quickly dropped into the furnaces. Here it is subjected to moist combustion by means of a blast of air charged with water vapor at a regulated temperature. The resulting gases contain paraffin tars, acetic acid, and ammonia. The paraffin tars are removed by the Woltereck scrubber, which retains all tarry matter without causing any condensation and consequent loss of ammonia. The acetic acid is next absorbed in the alkali tower, where the gases meet a hot solution of soda or milk of lime and combine with it to form acetate of soda or of lime, which may afterward be treated for the recovery of acetic acid or the production of acetone. The gases pass from the alkali tower to the acid towers, where they meet a stream of hot sulphuric acid, which combines with the ammonia to form sulphate of ammonia, the chief object of the process. After the acid is completely neutralized it is drawn off to the crystallizing vats. The solution of the sulphate is there further concentrated and allowed to crystallize, and after centrifugalizing to remove any adherent liquor, is ready for shipment.

Sea Lion Rookery, Bogostoff Island.

The paraffin tar is drawn off from the scrubber, when a sample of the oil therein solidifies on cooling. It is then subjected to distillation to remove the lighter oils, and a crude paraffin wax worth about $19.50 a ton remains without further purification. The acetate solution obtained from the alkali tower is evaporated to dryness and distilled with sulphuric or hydrochloric acid to obtain concentrated acetic acid, or can be subjected to dry distillation to produce acetone.

The leading purchasers of spirits of turpentine from the United States are the United Kingdom, Belgium, Germany, and the Netherlands. Of the total quantity exported, in 1905, 13,297,702 gallons, or 83.7 per cent, went to these countries. During the same period 1,508,189 barrels, or 65.3 per cent of the total quantity of rosin that was exported was sent to Germany, the United Kingdom, and the Netherlands. The imports of these products for 1905 were insignificant, only 43,063 gallons of spirits of turpentine and no rosin being imported.

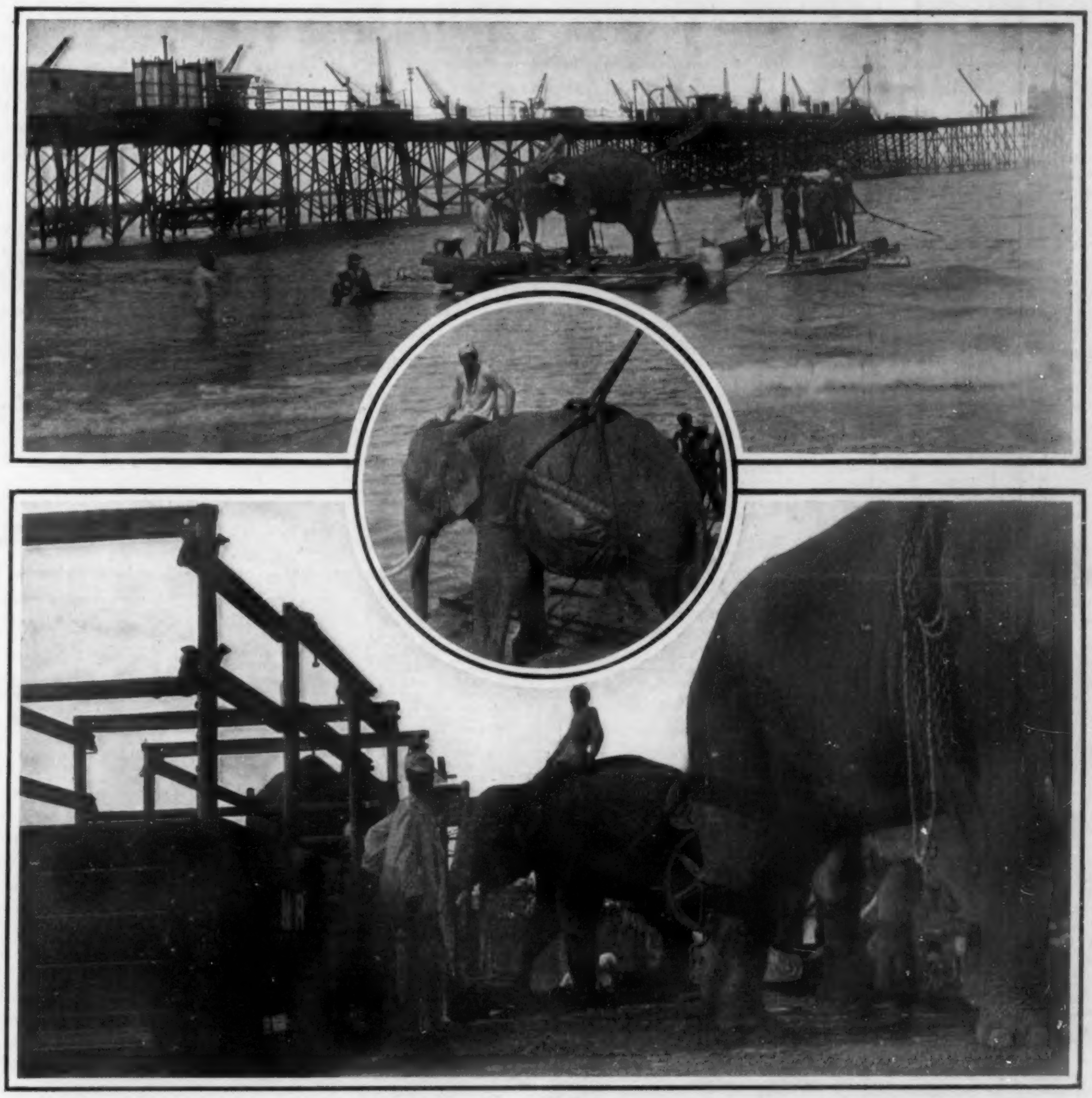
In Hawaii even private lands in forest are sometimes administered by the Territorial Board of Agriculture and Forestry. Some of the lessees of public land within the Koolau Reserve have turned over to the Board for administration both their leased and their private lands, amounting in all to 27,000 acres.

THE INDIAN GOVERNMENT'S ELEPHANT SERVICE.

BY W. G. FITZ-GERALD.

One-fifth of the entire population of the globe is found in the Indian peninsula, chiefly in agricultural village communities, divided in many cases by great forest tracts abounding in big game. Foremost among this game come the wild elephants, which have played so important a part in the economy of Hindostan ever since the days of the Mogul empire. Elephants indeed are employed in all branches of the civil and military services; and their duties range from hauling artillery over the Himalayan passes to stacking teak logs in the big sawmills of Rangoon and Moulmein in Burma.

All the wild elephants of India are government property, except in the native territories, where they belong to the feudal princes. These potentates have very different uses for the big tuskers. In a state like Mysore newly-tamed elephants are used in tiger hunts, and also for the great *tamashas*—those gorgeous festivals which have been such a notable feature of India for thousands of years. Fights between elephants and also elephants and tigers are common features at such entertainments.



Top View—Ferrying an Elephant Through the Surf to the Steamer. Center View—Slinging an Elephant on Shipboard. Bottom View—Entraining a Herd of Elephants in Specially Constructed Cars.

THE INDIAN GOVERNMENT'S ELEPHANT SERVICE.

But to see the wild elephant traffic at its best, one must visit the center of this curious industry, which is Dacca in Bengal. To such a point newly-trapped elephants are marched by a small army of men, then lodged in vast stables, and drawn upon as required for government and private service. All the railroads, particularly in South India, maintain specially-constructed elephant trains; and up and down the coast ply entire fleets of steamers, likewise specially built for the elephant traffic. Altogether, there are at least 17,000 men employed in the Elephant Service of the Indian government; and these have both native and white officers. Every military post has its battery of working elephants, each capable of marching forty miles a day with a load of half a ton—ideal freight animals for so wild a country, where in many parts roads are wholly unknown. Dacca is the headquarters of the Bengal Elephant-Catching Establishment of the Indian government. It lies on a branch of the Ganges, and its environs supply enormous quantities of water grasses as fodder. The city is also within 190 miles of the great forests of Chittagong, Sylhet, and Cachar, where the wild tuskers are trapped in great *kheddahs* or staked inclosures. This work is easily the most remarkable of government undertakings, and quite a small army is deputed for the purpose, headed by officers whose knowledge of woodcraft and elephant wiles is nothing short of miraculous.

Outside Dacca is an enormous *peelkhana*, or elephant depot, over one square mile in extent. This great square is ditched on every side; and in the center huge herds of tuskers are picketed in long rows awaiting the periodical auctions, and afterward transported by sea and land to all parts of India. Each elephant stands on a square of concrete, with iron posts at head and feet. To these the great creatures are roped.

In the middle of the huge quadrangle is a shed roofed with wet grass; here the delicate animals are kept during the heat of the day. There is even a hospital; and adjoining are warehouses for howdahs, gear, and stores, as well as the offices of physicians and surgeons, who treat both attendants and animals.

All these buildings are close to the river, so that the elephants may have easy access to water. This also insures the carriage by boat of enormous quantities of green fodder.

The elephant-trapping armies leave Dacca at the end of November, and are practically lost for four months in the great forests of Chittagong. Some time in May the white officers return with their motley "army," driving before them hundreds of captured tuskers. The methods of trapping are simple enough. For some days an army of beaters, hunters, and general laborers track the herd through the jungle; and when the feeding ground is reached, the laborers set to work felling trees and constructing a huge inclosure draped with creeping plants. This is the *kheddah;* and it has a funnel-shaped opening with a drop-door secured by a cable in such a way that one stroke of an ax will bring it down as soon as the last elephant is within.

The construction of the trap complete, the beaters set up a terrific din with tomtoms, gongs, and fireworks. The bewildered elephants are driven toward the mouth of the funnel, down which they press until they reach the narrow entrance to the inclosure. When the last elephant is driven in, down comes the great door; and after a day or two's rest for all the elephant-catching army, trained mahouts ride in on tamed elephants to conquer the wild specimens. One of the latter is handled by two tame tuskers; and if he shows fight, they punish him severely. As a rule, however, the newly-taken monster soon submits.

Needless to say, this queerest of government work is full of excitement. For in one herd there may be eighty or ninety enormous creatures, many of them uncertain in temper and full of fury at being trapped. After the elephants have been tamed, they are roughly classified. Some are pre-empted for the native princes; others set aside for the commissariat, transport, and artillery services.

Some may die on the march back to Dacca; and the least valuable are put up to public auction, when they fall to the lot of private merchants and companies.

The service is now officered entirely by white men, for the native mahouts were found to be both cruel and tricky. Some native officers seemed to think the elephant's health and strength could be maintained on a semi-starvation diet. As a matter of fact, the elephant is a delicate creature, liable to sunstroke and other ailments. In his eighteen waking hours the elephant will eat over 700 pounds of lush fodder. He throws aside a good deal; if you give a big working elephant 800 pounds of long-stalked dhall grass, he will probably waste 100 pounds of it. Sometimes, however, a change of diet will be recommended by the government "vets," and 750 pounds of dry sugarcane will be substituted for the grass.

In Dacca specially-trained British officers take charge of the vast elephant clearing house, and are in constant touch with all parts of the empire, from the Himalayas to the extreme south. They regulate the transport and forwarding of the elephants by the special trains and fleets of steamers built for the purpose. Sometimes an order for sixty tuskers will be received from an important military center like Lahore. Such animals are selected by experts. And each is required to possess high intelligence, a good temper, and much capacity for work. He is taught to salute with his trunk, to haul a big gun, and to do many tasks entirely unaided. The selected animals are entrained in specially-built freight cars — a highly troublesome business. Many attendants travel in these trains, to calm their terrified charges.

Arrived at the coast, several vessels of the elephant fleet are seen out in deep water; while near at hand in the surf are half a dozen massive rafts, manned by natives of many years' experience in the ticklish work of rafting the giant tuskers out to the ship's side. Clearly, this requires much patience and ingenuity; for many a tusker coaxed even a little way into the surf, will bolt back, screaming with terror and fury. At last each of the great creatures is fairly planted on the beams of the raft and his legs securely lashed. Then comes the journey out, and this is possible only in good weather. Meanwhile great slings of canvas, rope, and chain gear have been prepared on board; and after a few moments' wait the slings are lowered, and the elephant strapped in in such a way as not to hurt him. Then at a given signal the winch rattles, and the huge creature of five or six tons is swung high into the air, and landed at length on the ship's deck.

Some vessels of the elephant fleet will carry 300 tuskers with their trained attendants. The last animal on board, the ship weighs anchor and passes down the coast, landing an elephant or two here and there, according to the needs of peace or war.

It is stated that the Russian Admiralty has decided on the construction at the Baltic works of two battleships of 25,000 tons, to be completed within two years. They will be armed with ten 12-inch and six 8-inch guns.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

HAT-GUARD.—A. FORNANDER, New York, N. Y. The device consists of a short elastic cord provided with clips at each end which may be respectively secured to the sweatband of the hat and the shirt collar. When the guard is not in use the cord may be coiled up and the two clips secured to the sweatband.

SUSPENDER-END.—H. WEISS, New York, N. Y. The invention provides a suspender-end with a projecting ear at one side adapted to support a strap used for supporting a garment. The suspender-ends and the projecting ears are of such form that they may readily be cut out of blanks.

Electrical Devices.

PLUG-IN SWITCH.—H. D. MURDOCK, New York, N. Y. The invention relates to electrical switches of the so-called "plug-in" type, and has for its particular object the provision of a construction containing an electric circuit divided in parallel into two branches which are respectively connected with electric lamps. The arrangement is such that by inserting the plug one of the branch circuits is opened and the other closed.

ELECTRIC STOP-MOTION.—F. A. SANDFORD, Adams, Mass. The invention relates to looms and its object is to provide an improved electric stop-motion arranged to automatically stop a loom in case a warp thread breaks. The action takes place by connection with the ordinary stop-motion actuated when the weft filling runs out or breaks.

Of Interest to Farmers.

BALING-PRESS.—H. B. TROUT, Shelbyville, Ill. The object of the invention is to provide an improved baling press of the type actuated by steam power, arranged to insure the economical use of the steam and to increase the compressing force of the engine in the last portion of the compressing period by an increase in the motive agent and by direct application of the increased force on the follower.

THRESHING-MACHINE FEEDER.—D. McIVOR, Crookston, Minn. An improved device is provided by this invention for feeding the bundles of grain to a threshing machine. The invention consists in a novel means for facilitating the feed of the bundles and for cutting the same and loosening up and uniformly feeding the same to the threshing cylinder.

FENCE.—C. I. SAUNDERS, Fowler, S. C. The fence is provided with means for tightening up the fence wire. These means consist of U-shaped leaf springs which are bolted to the posts and at their opposite ends are attached to panels of woven wire. When barb wire is used, it may be applied without cutting, at the same time permitting the springs to operate on each panel.

Of General Interest.

DIVER'S HELMET.—P. HANSEN, Copenhagen, Denmark. The helmet as constructed by Mr. Hansen is lighter than the ordinary helmet and may be quickly buckled on. The collar of the diver's dress is formed with a thickened edge. Beneath this a ring is placed provided with two bolts and over this the helmet is seated and made fast by a pair of nuts tightened on these bolts.

MANIFOLDING SALES-BOOK.—A. L. SCHULTZ, Pocahontas, Iowa. The invention relates more particularly to order books, and the like, its principal object being to provide the cover with a separable mounting for a filler, and with a convenient holder for a carbon sheet. This enables the carbon sheets to be transferred from one leaf to another without soiling the operator's fingers.

Hardware.

LIFTING-JACK.—G. R. BOOTH, Chana, Ill. The jack consists of a standard in which a lifting bar is slidably mounted. At one side a load-supporting step may be adjustably supported on a toothed surface of the bar, while the opposite side is provided with rack teeth adapted to be engaged by the elevating mechanism. A spring pawl serves to hold the bar at the desired adjustment and also serves as a brake in lowering the load.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending October 15, 1907.

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Abrading device, J. R. Scott 868,021
Accounting appliance, credit, R. D. Pardee. 868,118
Acid, making lactic, J. A. Just 868,444
Advertising device, H. W. Gardner 868,542
Air brake system, H. N. Ransom 868,481
Air brake system, C. E. Barry 868,502
Airship, M. Schiavone 868,223
Album, card, H. D. Lentz 868,458
Alcohol and obtaining the same from carboxylic compounds, Bouveault & Blanc. 868,232
Aldehydes and solutions thereof, making, H. S. Blackmore 868,320
Alloys by heating and chilling, improving aluminium, F. G. A. Wilm 868,383
Ammunition wagon or caisson, Schneider & Rimailho 868,224
Amusement device, Stewart & Greer 868,369
Animal, mechanical, J. Hubsch 868,564
Animal trap, I. W. Jones 868,568
Annealing or heating of metals, Bates & Peard 868,154
Audiphone, J. A. Baker 868,245
Automobile, E. W. Roberts 868,014
Automobile fender, reversible, L. P. Barrett 868,319
Awning, F. Thoms 868,146
Axle, car, L. Hall 868,553
Bag holder, J. Hulbert 868,269
Bag holder, E. Taylor 868,504
Bake pan, M. A. Wilcox 868,312
Baking pan, C. E. Pierce 868,121
Baling press, J. J. Stopple 868,142
Band cutter and feeder, W. E. Donner 868,163
Bearings, cage for rolls in roller, C. S. Lockwood 868,105
Bedclothes supporting device, E. L. Tyrrell. 868,037
Beet topper, Blevins & Giddings 868,593
Belt guide and shifter, R. E. Horinek 867,974
Berth and seat for passenger carriages, combined, D. T. Owen 868,002
Bicycle guard, J. B. Lockwood 868,461
Bicycle propelling mechanism, H. S. Corbitt 868,329
Bicycle, water, J. Heggen 868,183
Billard cue chalking device, R. E. Gunsolus 868,549
Binder, loose leaf, R. B. Wilson 868,239
Binder, loose leaf, Schneller & Henke 868,491
Boiler compound, J. Williams, Jr. 868,149
Boiler flue cleaner, W. J. Bradley 868,403
Boilers, steam ash remover for, J. A. Kretzer 868,455
Book mark, J. F. Orgain 868,470
Books, tablets, etc., backing machine for, J. G. Klink 868,451
Boot and shoe, composite, H. C. Richardson 868,484
Boot and shoe finishing machines, rotary operating member for, W. W. Crooker.. 868,532
Bottle, C. B. Wiltse 868,516
Bottle closure and seal, Schonert & Schweitzer 868,225
Box-lid fastening, J. W. Evans 868,334
Brake head, adjustable, Bauer & Susemihl.. 868,323
Breeching device, T. B. Bradford 868,072
Brick machine, F. Mueller 868,355
Brick machine, B. C. White 868,515
Bridle, bitless, Van & Ellingsen 868,040
Brooder, J. Goetze 868,262
Brush holder, F. P. McBerty 868,467
Brush manufacturing apparatus, H. Weibermuller 868,237
Bucket and cooker, combined, M. M. Mauck 868,465
Bucket and similar vessel, milk, S. E. Bell 867,940
Bucket, turbine, W. L. R. Emmet 868,419
Buckle, cross-line, Dill & Hill 868,161
Building block, J. Cilek 868,411
Burglar alarm, H. K. Geiger 868,543
Burglar alarm and sash lock, combined, J. W. Carpenter 868,529
Butter cutter, A. C. Hummer 868,342
Button and necktie holder, combined collar, D'Aversa & Campanello 868,535
Cable hanger, T. A. Walsh 868,511
Cables, pipes, rods, and the like, and in a flux therefor, jointing of, Smith & Harden 868,498
Cam, adjustable, Hanson & Montstream.... 868,086
Can opener and seal, milk, E. D. Waterbury 868,512
Can tapping apparatus, F. J. Heybach 868,605
Candy-working machine, F. H. Richards.... 867,010
Car bolster and draft rigging, combined, W. D. Lowry 868,463
Car construction, railway, M. Kennedy 868,096
Car door fastener, grain, Evans & Flynn... 868,539
Car fender, J. T. Tighe 868,035
Car fender, B. Lev 868,103
Car steering and braking device combined, motor, E. H. Geist 868,337
Car step, folding, Reeves & Shane 868,482
Car wheel fender, J. Hoefling 867,971
Car windows, preventing the collection of snow and sleet upon, G. M. Little 868,279
Cars, discharge for tank, W. D. Russell.... 868,130
Carbureter, L. Bollee 868,251
Carbureter for internal-combustion engines, E. V. Hartford 868,265
Carpet fastener, separable, W. H. Boles.... 868,070
Carrier. See Elevated carrier.
Cart, push, J. T. Koen 868,099
Carton marking attachment for carton setting-up machines or the like, W. H. Doble 867,956
Cartons, machine for closing and sealing the top flaps of, C. Redd 868,292
Casein soluble to a neutral solution, preparing, J. A. Just 868,445
Cataphoric apparatus, T. J. Randall 868,123
Cellulose, paper pulp, etc., strips capable of being spun, preparing from, A. Leinveber 868,193
Cement, mold for veneering walls with, J. G. Mills 868,284
Centrifugal separator for wood pulp and similar materials, A. H. Holden 868,341
Ceramic ware for firing, bedding, E. Mayer. 868,106
Chain-making machine, R. Muller 868,285
Chair dowel for building purposes, W. H. Wilson 868,053
Checking, registering, and recording mechanism, A. Boos 868,625
Cheese cutter, W. G. Doty 868,626
Chuck, W. A. Oubridge 868,471
Chuck, drill, Kuhs & Petig 868,101
Clasp knife, J. C. Griswold 868,179
Clock, self-winding, A. F. Poole 868,581
Clock, self-winding electric, C. W. Wagner. 868,587
Cloth cutting machine, A. Bosshard 867,944
Clothes line, J. R. Davidson 868,536
Clothes rack, J. A. Newman 868,112
Clothes rack, G. C. Potter 868,477
Clutch and transmission device, hydraulic, C. H. Tingley 868,304
Clutches, shipping device for friction, C. J. Moore 868,108
Coffee pot and steeper, C. Hoffman 868,561
Coin collector circuit, A. F. Dixon 867,955
Coin controlled mechanism, H. Blum 868,398
Column, post, and the like, metal, S. Grossman 868,429
Columns, etc., base for, C. E. Zimmermann. 868,314
Compressed air motor, C. D. Jenkins 868,441
Compressed air tank, W. J. Griffin 868,548
Concrete reinforcement, J. S. Barnes 868,065
Condenser, surface, L. R. Alberger. 868,388 to 868,390
Control system, A. S. Mann 868,464
Controller, C. E. Lord 868,573
Controller operating mechanism, C. T. Crocker 868,531
Conveyer, package, M. C. Schwab 868,020
Conveying device, J. D. Musser 867,995
Cooler, E. Neely 868,287
Coring device, apple, E. C. Hedborg 867,970
Corn and fruit spoon, D. Schuyler 868,583
Corn-husking machine, G. A. & A. H. Welch 868,046
Corset, J. Lindauer 868,196
Cot, extension, H. B. Whitlock 868,048
Cotton chopper, J. Chamness 867,946
Counter, recording, F. L. Wolfe 868,055
Coupling, J. J. Rollins 868,486
Cover, removable, M. H. Berry 868,067
Coverings, producing, G. F. Bishopric 868,157
Cows, antikicking device for, H. J. O. & J. T. Reed 868,125
Crane, H. A. Thomson 868,032
Crate, folding, W. James 868,440
Crate or case, collapsible, J. S. McKibbin.. 868,214
Cream separator, A. S. Stenborg 868,140
Cross-arm support, E. E. Yaxley 868,591
Crucible furnace, portable, M. Harvey 868,181
Cuff holder, G. E. Baker 867,937
Cultivator, T. Mulally 868,356
Cultivator, lister, C. H. Melvin 868,107
Culvert, J. S. Bayer 868,524
Curtain fastener, A. Freschl 868,082
Curtain pole, W. C. Neal 868,469
Cutting, perforating, and roll forming mechanism, C. E. Pope 868,361
Davenport, A. M. Padmore 868,472
Decanting apparatus, J. V. N. Dorr 867,958
Dental regulator and spacer, E. M. Flagg.. 868,628
Derailing switch, Lindsay & Carroll 868,197
Desk, sorting, S. A. Harrison 868,434
Die and die-block, M. S. Carnegie 868,325
Diffusion apparatus, F. Closs 868,328
Digger. See Post hole digger.
Dish washer, J. M. Gilbert 867,968
Dispensing can, C. Goodchild 868,426
Display stand, locking, S. D. McMillan.... 867,996
Door check, L. C. Norton 868,357
Door, grain, M. Kennedy 868,097
Door hanger, H. C. Swafford 868,144
Door stop, O. T. Lucas 868,200
Draft equalizer, Chrysler & Kays 868,597
Draft equalizer, E. O. Doak 868,601
Dredging apparatus, S. Lake 867,984
Drying apparatus, J. A. Just 868,446
Drying machine, rotary, R. G. Poncet 868,475
Drip trough, J. M. Cramer 868,413
Dumb-waiters, well door for, A. E. Fischer. 868,422
Dye and making same, anthracene, R. Bohn 868,399
Dye and making same, vat, A. Schmidt.... 868,295
Egg beater, G. L. Raymond 868,124
Electric cable coupling, b'Hoest & Pieper.. 868,460
Electric light circuits, door operated electric switch for, J. Kramer 868,348
Electric machine, dynamo, C. D. Knight... 868,190
Electric machine, dynamo, W. D. Pomeroy. 868,580
Electric wires, terminal or connecting clip for, Sobner & Benjamin 868,300
Electrical distribution system, E. Weintraub 868,379, 868,380
Electrical resistance support, F. Johannsmeyer 868,272
Electrode, arc lamp, C. P. Steinmetz 868,502
Electromagnetic apparatus, J. McIntyre.... 868,468
Elevated carrier, P. H. & H. C. Iblings.... 868,186
Elevator shaft door mechanism, C. W. Kirsch 868,449
Enameled ware, W. A. Dunlap 868,078
End gate, wagon, W. L. Graham 868,545
Engine controlling apparatus, heat, E. P. Noyes 868,358
Engine indicator, T. Davidson 867,953
Engine indicator, F. L. Wolfe 868,056
Engine muffler, gas, J. B. Hoover 867,973
Engine reversing switch, gas, E. P. Du Pont 868,476
Engines, interheater for compound compressed air, C. B. Hodges 868,560
Engines, spark plug for explosive, F. W. Brady 868,404
Envelop feeding apparatus, F. C. Jenkins... 868,093
Envelop, return, W. T. Johnson 868,273
Evaporating process, J. A. Just 868,447
Excavating bucket, H. Channon 868,595
Excavating dippers, tooth for, H. J. Barnhart 868,066
Excavating rock tunnels, P. Ford 868,259
Excavating shovel, H. Channon 867,947
Excavator, O. Hetlesaeter 868,267
Exercises, apparatus for hand gymnastic, A. Krizek 867,981
Explosion engine, H. Sohnlein 868,301
Extension table, E. A. Fuller 868,423
Fabric expanding or stretching apparatus, textile, P. W. Kiernan 868,098
Fan ventilator, J. W. Miller 868,206
Faucet and strainer, combined, R. B. Disbrow 868,255
Feeding apparatus, time-controlled stock, W. R. & J. W. Tarte 868,227
Ferruginous blende, treating, W. M. Johnson 868,345
Fiber tubes, machine for making vulcanized, T. Hansen 868,555
Fibers from the pulp and extraneous matter of plants and trees, machine for separating, E. Behrendt 868,525
Fibers from the pulp and other extraneous matter of plants and trees, machine for separating, E. Behrendt 868,396
Fibers from the pulp of plants and trees, machine for separating, E. Behrendt.... 868,526
Filter, centrifugal, Nilsson & Jonson 868,288
Filter, oil, W. C. Fahy 868,257
Filters, making, G. M. Kneuper 868,277
Fire escape for buildings, movable, A. S. Olney 868,117
Fire extinguisher sprinklers, implement for closing the discharge openings of automatic, Wood & Tefft 868,058
Fire extinguishing apparatus and fusible link employed therewith, automatic sprinkler for stationary, W. Esty 868,602
Fire extinguishing sprinkler, G. F. Hall.... 868,432
Fire hydrant, W. H. Featherstone 868,080
Fires, apparatus for the use of carbon dioxid for extinguishment of, E. F. Osborne 868,218
Firearm, W. J. McKee 868,616
Firearm sight, J. Windridge 868,240
Fireproof construction, centering for, C. D. Oliver 868,116
Fishing rod guide, E. Holzmann 868,563
Flash boiler, A. L. Riker 868,012
Floor cleaning device, J. E. Gee 867,967
Fluid charging and discharging device, compressed, G. A. Bobrick 867,942
Flying machine, J. W. Roshon 868,488
Flying machines or airships, mechanism for winged, J. U. de Uberkocz 868,038
Flying machines or airships, steering gear for winged, J. U. de Uberkocz 868,039
Folding machine, B. A. Slocum 868,024
Food chopper, J. A. Hurley 868,344
Force-feed lubricator, A. Finch 868,174
Force-feed lubricator, A. A. Steltting 868,585
Forging machine, J. R. Blakeslee, Jr. 868,321
Fork, W. J. Jerkins 868,094
Foundations, dams, sea walls, and the like, system of construction for, F. Hennebique 868,092
Funnel, W. H. Ash 868,394
Furnace blast connection, J. W. Deetrick... 868,416
Furnace charging device, blast, C. P. Turner & J. W. Dougherty......868,506 to 868,508
Furnaces, charge-distributing apparatus for blast, W. Kennedy 868,346
Furnaces, device for arresting the explosion discharge from blast, L. Larsson 868,102
Furniture standard fastener, adjustable, W. S. Stanley 868,501
Fuse box, J. O. Stivers 868,141
Gage. See Marking gage.
Game apparatus, G. M. Muller 868,209
Garbage cremator, D. E. Bennett 867,941
Garters, separable fastener for, J. M. Siner 868,298
Gas, preparing illuminating, W. H. Gartley. 868,603
Gas burner, V. W. Blanchard 868,249
Gas burning apparatus, V. W. Blanchard... 868,250
Gas fittings, coupling device for, R. N. Oakman 868,113
Gas for explosive engines, generating oil, F. H. Bates 868,246
Gas generator, P. Meyer 868,205
Gas generator, acetylene, J. E. Goffin 868,425
Gas generator, acetylene, E. M. Rosenbluth 868,293
Gas lighting and extinguishing apparatus, automatic, A. B. Shaw 868,297
Gas producer, M. V. Smith 868,026
Gas producers, furnaces, etc., feeding mechanism for, J. A. Waldburger 868,147
Gas tap or valve, self-closing, C. De Albertis 868,415
Glass drawing apparatus, sheet, Colburn & Washburn 867,948
Glass melting and drawing apparatus, L. A. Thornburg 868,034
Glass sheets, method and apparatus for making, W. T. Nicholls 868,578
Gold and silver from ores, extracting, B. Hall 868,551
Gongs, etc., mechanism for, H. E. Reeve.. 868,221
Governor, B. H. Pascall 868,119
Grain bin, W. L. Finton 867,962
Grain rake, G. W. Smithson 868,027
Grain separator, W. Clement 868,412
Grain shocks and the like, rack for, E. Harrison 868,433
Grappling hook, J. C. Peterson 868,120
Grate, F. Girtanner 868,338
Grate, basket, W. W. Jones 868,188
Grinding machine attachment, J. T. Moltrup 867,991
Grinding pans, shoe and die of, Middleton & Cobbe 867,989
Grindstone flange, H. J. Frink 867,965
Hair cutting device, F. Kober 868,453
Hair waving device, E. Timanus 868,303
Hame, J. H. B. Butts 868,528
Harness ring, saddle, J. J. O'Kane 868,360
Harrow, H. U. Wakefield 868,510
Harvester and shocker, corn, F. M. Widerman 868,049
Harvester cutting mechanism, corn, F. M. Widerman 868,050
Harvesting machine, cotton, G. H. Zempter 868,061
Hasp and handle, W. D. Ferris 868,540
Hat and coat rack, locking, H. Viel 868,041
Hat cleaning and polishing apparatus, P. Bosso 868,323
Hat frame forming device, wire, D. M. Stanley 868,367
Hay loader, Plumer & Dorsey 868,003
Heating and ventilating system, C. H. Smith 868,299
Heel, cushion, J. Witkowski 868,054
Hide and skin stretching apparatus, M. Thorer 868,033
Hinge, A. Erler 868,173
Hinge and fastener, combined blind, J. N. Watrous 868,236
Hoe, J. S. Williams 868,148
Horse tail holder, O. B. Read 868,364
Hose coupling, C. T. White 868,311
Hose supporter, E. Warren 868,044
Hose supporter, F. E. Sharp 868,584
Hot air furnace, E. T. Marsters 868,203
Hot water heater, H. C. Goodrich 868,085
Husking implement, F. Schutterle 868,629
Hydraulic jack, Nelson & Mathers 867,997
Hydrocarbon burner, J. Gogel 868,084
Hydrocarbon burner, H. Lemp 868,457
Hydrocarbon motor, A. A. Low 868,281
Hydrocarbon motor, Low & Wassmann.... 868,608
Ice machinery, T. Shipley 868,495
Incubator, J. Homan 867,972
Incubators, egg turner for, F. T. Dirksen.. 868,162
Indicator. See Engine indicator.
Insect trap, M. C. Harlan 868,180
Insulated rail joint, B. Wolhaupter, 868,384, 868,517 to 868,520
Insulator, electric, F. J. Poinan 868,122
Insulator pin making machine, Mallory & Slaughter 868,575
Insulator, telegraph and telephone, J. A. Cooper 868,530
Internal combustion engine, A. Rollason.... 868,017
Internal combustion engine, N. Macbeth.... 868,202
Iron, oxid of, C. Wulfing 868,385
Iron, purifying, J. Misko 868,610
Ironing table, folding, A. M. Springer.... 868,500
Journal filer or smoother, car, M. F. Bagley 868,064
Kinetic energy from flowing gases and vapors, transforming nozzle for obtaining, R. Bergmans 868,397
Kitchen utensil, J. S. O'Brien 868,359
Knitting machine, circular, H. A. Klemm.. 868,276
Knitting machine take-up device, H. Donner 868,332
Knob, carriage curtain, F. A. Neider.... 868,111
Lacer, adjustable, Ryan & Wertz 868,131
Ladder, fruit picker's, E. Haycox 868,266
Lamp base, electric incandescent, F. H. Manchester 868,283
Lamp, electric, A. P. McArthur 868,110
Lamp, hydrocarbon, T. H. Blair 868,069
Lamp, oil vapor, Hendy & Stobart 868,184
Lamp plug, Parker & Jones 868,523
Lamps to effect electric ignition, apparatus for inclosing and electrically connecting miners' safety, Ackroyd & Best... 868,387
Lantern, J. M. Stokoe 868,503
Latch, gate, C. F. Mayo 868,466
Latch, hasp, E. Tyden 868,234
Lathe center, self-oiling, E. Keil 868,448
Lawn trimmer, W. H. Hamilton 868,554
Leak stopper, F. Maihama 868,574
Leather coloring matter, pulverulent, C. Reinhold 868,008
Leather or hide suspending hook, E. L. Post 868,004
Level, E. Helb 868,089
Leveling and stadia rod, combined, J. H. Robertson 868,365
Life saving apparatus, marine, C. Fuchs.. 867,966
Line drier, P. V. & L. G. Ericson 867,959
Linotype or composing machine, H. Drewell 868,538
Liquid in a vessel, apparatus for indicating the depth of, L. Murphy 867,994
Liquid separator, centrifugal, F. H. Reid.. 868,483
Lithopones by electrolysis, manufacture of, J. B. & A. Candau 868,253
Lock, H. G. Voight 868,235
Lock, A. H. Harris 868,556
Lock casing, L. H. Mullikin........ 868,210, 868,211
Lock pin, M. C. Carlucci 868,408
Locker construction, P. M. Wege 868,309
Loom, A. A. F. Thiery 868,228
Loom shuttle box mechanism, W. M. Wattie 868,308
Loom shuttle box motion, G. F. Hutchins.. 868,271
Looms, filling feeder for filling replenishing, E. S. Stimpson 868,586
Looms, tape winder for tape, Holmes & Jenckes 868,268
Loop, C. S. Comstock 867,949
Lunch box, folding, J. F. Lyons 868,350
Magnesia granulating machine, M. Scozzari 868,617
Magnesium, production of, Seward & von Kugelgen 868,226
Mail box, G. A. Wirt 868,590
Marking gage, O. Obermeyer 868,114
Massage implement, A. Barker 868,522
Massage machine, W. D. Davenport 868,600
Massaging purposes, vibrating machine for, J. V. Daniels 868,534
Mattress filling machine, E. J. Antoni 867,936
Measure, liquid, F. Simpson 868,023
Measuring device, Z. Rable 868,363
Measuring instrument, electrical, F. W. Roller 868,128
Measuring the flow of liquids, apparatus for, L. B. Atkinson 868,152
Mechanical movement, H. B. Adler 868,316
Mechanical movement, F. H. Richards 868,582
Metallic case and like device, White & Wege 868,310
Metals, apparatus for the heat treatment of, T. V. Hughes 868,185
Milk can, J. W. Railey 868,479
Millstone dressing machine, R. C. Helms... 868,090
Mining machine chain, H. E. Rawlins 868,291
Moistener, envelop and stamp, T. F. Martin 868,609
Molding apparatus, F. X. Leuthner 868,607
Motion to sieve boxes and other bodies, means for imparting gyratory, E. R. Draver 868,333
Motive agent generator, J. L. Tate 868,372
Motor, C. E. Smith 868,497
Motor control, alternating current, F. Eichberg 868,171
Motor control system, H. E. White 868,381
Muzzle, dog, A. W. Swender 868,145
Nipple making machine, W. W. Doolittle, 868,166, 868,167
Nipples, making pipe, W. W. Doolittle... 868,168
Nursery seat, child's, M. Wolff 868,057
Nut lock, T. Hemp 868,091
Nut lock, A. E. Forsell 868,336
Nuts, screws, etc., locking arrangement for, C. A. Arbey 868,622
Oar lock, E. F. Ward 868,378
Oil burner, H. C. Finley 868,175
Oil can, J. F. Cody 868,075
Oil, paint, F. Dahlhaus 867,951
Oiler, J. W. Ladd 868,456
Ore testing tablet, J. E. Hunsinger 868,270
Organ lock, portable, P. P. Bilhorn 868,248
Overshoe, S. Schwarzschild 868,135
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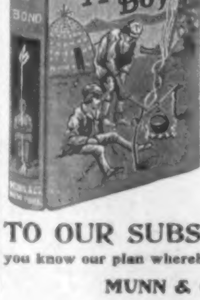

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